IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW

OF

APPLIED MYCOLOGY

VOL. XI JULY 1932

WEBER (G. F.). **Bottom rot and related diseases of Cabbage caused by Corticium vagum B. & C.**—*Florida Agric. Exper. Stat. Bull.* 242, 31 pp., 15 figs., 1931.

An expanded account is given of the bottom rot of cabbage caused by *Corticium vagum* [*C. solani*] in Florida, a preliminary note on which has already been published [*R.A.M.*, x, p. 421]. The incidence of the disease may be reduced by soil sterilization in the seed-beds and by careful cultivation, avoiding the banking-up of soil too close to the plants.

NELSON (R.). **Investigations in the mosaic disease of Bean (Phaseolus vulgaris L.).**—*Michigan Agric. Exper. Stat. Tech. Bull.* 118, 71 pp., 11 pl., 1932.

This is a comprehensive account of the results hitherto obtained by the writer and others in studies on bean (*Phaseolus vulgaris*) mosaic [*R.A.M.*, x, p. 283 *et passim*]. Notices of many of the papers cited have already appeared from time to time in this *Review*.

The disease was first recognized by Iwanowski in Russia in 1899 in connexion with his researches on tobacco mosaic (*Centralbl. für Bakt.*, Ab. 2, v, p. 250, 1899), and in the United States by Clinton in 1908 (*Connecticut Agric. Exper. Stat. Rept. of Botanist*, p. 859, 1909). It is now world-wide in distribution and of great economic importance, affecting all the chief commercial varieties of field and canning beans except Robust, as well as *P. vulgaris* var. *humilis*, *P. acutifolius* var. *latifolius*, *P. angularis*, *P. aconitifolius*, *P. calcaratus*, *P. mungo*, *P. lunatus*, *P. limensis*, *P. coccineus*, *Vicia faba*, and *Vigna sesquipedalis*. The symptoms of the disease on the highly susceptible Navy Pea and Refugee varieties are described.

Insect transmission of bean mosaic was accomplished in 1922 under controlled conditions with the potato aphid, *Macrosiphum solanifolii* [*M. gei*], but several years' field observations indicate that the bean leafhopper, *Empoasca fabae*, is more likely to be responsible for the rapid spread of the disease in the open. Seed transmission occurs to a variable extent. In plants grown from infected seeds, the virus is transmitted to about one-half. Generally speaking, infections that take place after flowering do not reach the seed. Evidence is adduced that the escape from infection

of a considerable percentage of the seeds is due to the particular type of vascular anatomy characteristic of the bean pod.

Full details are given of the coccus-like organisms which the author claims to have found in the disintegrating chloroplasts and also in the phloem and wood parenchyma of mosaic but not of healthy beans [ibid., ix, p. 423]. An extremely pleomorphic organism occurs in the leaflets and seeds of beans affected by rugose mosaic, which also contain cocci and *Rickettsia*-like organisms. Isolations from the affected tissues have yielded cultures of all these organisms, but neither the cocci nor the pleomorphic organism was able to reproduce mosaic on inoculation into healthy plants.

A four-page bibliography is appended.

REID (W. D.). **A bacterial wilt disease of Beans. Occurrence in Marlborough and measures for control.**—*New Zealand Journ. of Agric.*, xliii, 6, pp. 408–415, 4 figs., 1931.

This is a brief account of a bacterial wilt of French beans (*Phaseolus vulgaris*) which is stated to have been recorded for the first time in New Zealand in the Marlborough provincial district in 1931, into which it was presumably introduced with diseased seed from abroad. A survey showed that approximately 25 per cent. of the crops were affected, but the amount of disease varied considerably from one locality to another. The symptoms were similar to those typical of bacterial diseases of the bean in other countries [*R.A.M.*, x, p. 422], and isolations yielded an organism [a technical description of which is given] which in pure culture was found to resemble *Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola* [ibid., xi, pp. 18, 96] except for some differences in size, flagellation, and gelatine liquefaction. The author considers that the differences between his organism and *Bact. medicaginis* as originally described by Sackett are insufficient to place the former in the variety *phaseolicola*, and doubts the validity of this variety, which appears to be merely a form distinguished by its non-pathogenicity to lucerne.

The paper terminates with some considerations on the control of the disease.

BURKHOLDER (W. H.) & ZALESKI (K.). **Varietal susceptibility of Beans to an American and a European strain of Phytomonas medicaginis var. phaseolicola, and a comparison of the strains in culture.**—*Phytopath.*, xxii, 1, pp. 85–94, 1932.

The writers discuss and tabulate the results of their experiments on the reaction of 44 American commercial bean [*Phaseolus vulgaris*] varieties to inoculation with two American and one European strain of *Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola* [see preceding abstract]. The varieties reacted similarly to all the strains, some showing a high degree of susceptibility while others maintained considerable resistance To the former group belong Bountiful, Giant Stringless, seven Kidney and Wax varieties, and six others, while the latter includes Black Valentine, French Horticultural, eight Refugee and Wax varieties, Robust Pea, and six more. The remaining 12 varieties used in the tests are probably

of moderate susceptibility. No differences were observed in comparative cultures of the American and European strains of the pathogen.

Severin (H. H. P.). **Modes of curly-top transmission by the Beet leafhopper, Eutettix tenellus (Baker).**—*Hilgardia*, vi, 8, pp. 253–276, 6 figs., 1931.

Continuing his studies of the transmission of curly top of the beet by the leafhopper *Eutettix tenella* [*R.A.M.*, viii, p. 84], the author gives details of experiments which showed that previously non-infective insects can transmit the disease to healthy plants within 20 minutes of feeding on diseased beets, the percentage of successful transmissions increasing with the length of time the carriers were allowed to feed on the healthy plants, and also with the number of insects used in the tests. The shortest period necessary for a single insect to transmit curly top was seven hours, and only two or three per cent. of the single insect transmissions succeeded when the incubation period in the insect was less than 24 hours. The percentage of transmissions by single insects with virus incubation periods of one to seven days varied from 13·3 to 40, the lowest percentage occurring at the end of one day.

Further tests showed that when previously non-infective *E. tenella* nymphs were fed on an extract prepared from the mouth parts excised from infected individuals, they transmitted the disease to two beet seedlings, but the incubation period was prolonged to 24 and 34 days, respectively. Non-infective nymphs fed on culture media containing the excreta or a filtrate from the faeces of infective insects failed to transmit curly top to healthy beets.

Leach (L. D.). **Downy mildew of the Beet, caused by Peronospora schachtii Fuckel.**—*Hilgardia*, vi, 7, pp. 203–251, 10 figs., 1 diag., 2 graphs, 1931.

This is a detailed account of the author's investigation of the downy mildew (*Peronospora schachtii*) of the beet [*R.A.M.*, viii, p. 695] in California, in the central region of which it is stated to have attained considerable severity in 1929, causing particularly heavy losses (conservatively estimated at $100 per acre) in fields of garden beets grown for seed. The disease was also serious on market beets in the coastal districts south of San Francisco.

Field observations and experimental work showed that the fungus attacks the beets at all stages of development. In seed-beet fields infection of the inner rosette leaves is usually the most conspicuous symptom, but during wet periods secondary infection occurs as isolated areas on the outer leaves. Flower shoots are frequently invaded systemically, the entire inflorescence then assuming a stunted and compact habit. Infected bracts and flower parts are swollen, distorted, and discoloured. Mycelium and oospores of the fungus were found abundantly in the pericarp and sepals of beet flowers, and occasionally in the funiculus and integuments of the ovule. Mycelium and haustoria resembling those of *P. schachtii* were also found inside the testa of viable seed from seed balls bearing dry conidiophores on their surface.

Experiments under controlled conditions indicated that the conidia of *P. schachtii* can germinate within a range of temperatures from below 0·5° to near 30° C., with an optimum between 4° and 7°. The greatest development of the germ-tube in the first 24 hours occurred at 12°. A few of the conidia were still viable after 40 days at −1·5° C. A high percentage of infection was obtained on seedlings sprayed with conidial suspensions at temperatures between 0·5° and 20°, but at 30° infection was slight. The cotyledons and newly formed leaves were the most susceptible portions of the seedlings.

Inoculation experiments gave positive results on ten varieties of garden beets, nine of mangels, and three of sugar beets, and also on *Beta vulgaris* var. *cicla* (Swiss chard), *B. bourgaei*, *B. macrocarpa*, *B. maritima*, *B. patellaris*, *B. patula*, *B. procumbens*, *B. scutellaris*, and *B. vulgaris* var. *abyssinica*. No infection was obtained on *Chenopodium album*, *C. murale*, and spinach, while *P. effusa* from spinach failed to infect beet and Swiss chard.

The investigation also confirmed that beet downy mildew is transmitted with the seed, and that the organism may hibernate by means of perennial mycelium in the crown of the beets. While no adequate control measures are yet known, a measure of protection may be attained by the use of disease-free seed, avoidance of infected soils, and the elimination of infected seedlings.

HENDERSON (W. J.). **Studies of the properties and host reaction of the Onion to the yellow-dwarf virus.**—Abs. in *Phytopath.*, xxii, 1, p. 11, 1932.

In sterile distilled water at 25° C., the virus of yellow dwarf of onions [*R.A.M.*, x, p. 499] is inactivated after 112 hours, and in onion leaves at the same temperature, after 100 hours. The thermal death point of the virus, when heated for 10 minutes, lies between 75° and 80° C. The infective capacity of the virus was not impaired by 10 minutes' freezing at −10°. Eighty per cent. of healthy bulbs inoculated in the growing tips with two hypodermic injections of 0·75 c.c. each became infected. Three injections, of 0·42 c.c. each, infected 72 per cent., and one of 2 c.c. was pathogenic to 25 per cent. of the plants. Healthy onions, inoculated in the leaves at a height of 1½ inches, showed symptoms on 35 to 40 per cent. of the plants during the current growth, while 50 to 60 per cent. showed masked symptoms in the next growth period. When inoculated at a height of 4 to 6 inches, the plants showed 5 to 20 per cent. infection during the current growth and 25 to 40 per cent. in the second growth periods. The inoculation of plants 7 to 8 inches in height failed to cause yellow dwarf symptoms in the first growth period but led to the development of 25 to 30 per cent. during the second.

DORAN (W. L.) & BOURNE (A. I.). **Onion spraying and dusting experiments.**—*Massachusetts Agric. Exper. Stat. Bull.* 279, pp. 176–185, 1931.

The results [which are discussed and tabulated] of three years' experiments in Massachusetts in the control of downy mildew (*Peronospora schleideni*) and blast of onions [*R.A.M.*, ix, p. 629]

showed that copper-lime dust injured the plants in two out of three seasons and failed to control blast. Bordeaux mixture 4:4:50 and 8:4:50 did not harm the plants when applied with a suitable power sprayer at a pressure of 100 to 150 lb., and resulted in a somewhat increased yield even in the absence of both diseases. The onset of blast was delayed, but not prevented, by Bordeaux mixture, and the increased yields due to the treatment were not sufficient to justify the annual spraying of onions since the diseases in question are not of constant occurrence.

DAVIS (G. N.) & REDDY (C. S.). **A seedling-blight stage of Onion bulb rot.**—Abs. in *Phytopath.*, xxii, 1, p. 8, 1932.

Heavy losses have been caused in the Clear Lake [California] district by a seedling blight and bulb rot of onions caused by a *Fusarium* resembling *F. zonatum* form 1 [*R.A.M.*, viii, p. 280]. In seedlings the tips whiten, and then die back following infection of the roots which at first show a dull, leaden discoloration and then decay. Bulb rot occurs both in the field and in storage. In some plots only half the original stand remained at harvest and this was largely diseased, while in one large field 90 per cent. of the plants were lost and the crop was a failure.

WEBER (G. F.). **Spraying and dusting Cucumbers for control of downy mildew from 1925 to 1930.**—*Florida Agric. Exper. Stat. Bull.* 230, 58 pp., 1 fig., 1931.

A review is given of the literature on the control of downy mildew of cucumbers (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*), together with a report of experimental results obtained during the period 1925–30 in Florida [*R.A.M.*, x, p. 646]. While copper stearate dust was the most effective fungicide, it was considerably more expensive than the almost equally beneficial 2-4-50 Bordeaux mixture, the cost per hamper of the increased yield being 42 cents for the former preparation compared with only 16½ cents for the latter. The corresponding figure for copper-lime dust, which also gave very good control, was 50 cents per hamper. In comparison with the untreated plots those sprayed with Bordeaux mixture and copper-lime dust produced 14 and 13 per cent. more fruit, respectively. Five applications of the fungicides were necessary to ensure adequate control. Hydrated lime was found to be a good substitute for rock lime in the preparation of Bordeaux mixture. Sulphur in various forms injured the plants.

GREEN (D. E.). **Note on the disease resistance shown by Butcher's Disease Resister Cucumber to Cercospora leaf spot.**—*Journ. Roy. Hort. Soc.*, lvii, 1, pp. 63–64, 1 pl., 1932.

In recent outbreaks in England of the leaf spot of cucumbers due to *Cercospora melonis* the Butcher's Disease Resister variety has again maintained its resistance [*R.A.M.*, ix, p. 358]. All attempts to arrest the spread of infection on the susceptible Jasper Queen by fumigation with sulphur, soil sterilization and disinfection of the houses with formalin, and spraying the plants with liver of sulphur gave negative results. The use of the Disease Resister variety

appears to be the sole means of eradicating this extremely troublesome fungus from the greenhouses.

LAYTON (D. V.). **Host response of Citrullus vulgaris to Colletotrichum lagenarium.**—Abs. in *Phytopath.*, xxii, 1, p. 16, 1932.

The maximum amount of infection was produced on watermelons by *Colletotrichum lagenarium* in the greenhouse at 20° to 28° C., with a relative humidity of 93 per cent. [*R.A.M.*, viii, p. 294; x, p. 771]. Less infection occurred at 17° and none at 15° with 90 per cent. humidity. A high degree of resistance to the fungus was shown by the citrons (especially Majorta, an African forage melon), but most of the oriental varieties were decidedly susceptible. The F_2 and F_3 generations of citron-watermelon hybrids were considerably less susceptible than commercial watermelons, while marked resistance has further been shown by several inbred segregates from chance edible hybrids of Conqueror, viz., selections from Iowa Belle (Q 21), Iowa King (Q 23), and Q 20, which are also resistant to wilt [*Fusarium niveum*: ibid., x, p. 431].

SLEETH (B.). **Physiologic strains of Fusarium niveum.**—Abs. in *Phytopath.*, xxii, 1, p. 24, 1932.

The failure of the Conqueror watermelon to maintain its resistance to wilt (*Fusarium niveum*) [see preceding abstract] in certain melon-growing sections suggested the possible existence of strains of the fungus with varying degrees of pathogenicity. Cultures of the organism were obtained from Texas, North and South Carolina, Iowa, and West Virginia, and greenhouse experiments were conducted during 1930–1 to determine the relative degree of pathogenicity of the various strains to different watermelon varieties. Tested on six varieties, strain 3 produced an average of 90 to 95 per cent. wilting; strains 8 and 6, 85 to 90 per cent.; strains 4 and 1, 80 to 85 per cent.; strain 2, 70 to 75 per cent.; strain 7, 65 to 70 per cent.; strain 5, 45 to 50 per cent.; and strain 9, 20 to 25 per cent. Twenty-three strains of *F. niveum* have been isolated, which exhibit cultural characters indicating the possible occurrence of as many physiologic forms.

DUFRÉNOY (J.). **Sur les facteurs écologiques du développement du Plasmopara viticola.** [On the ecological factors of the development of *Plasmopara viticola*.]—*Comptes rendus Soc. de Biol.*, cviii, 36, pp. 967–970, 2 graphs, 1931.

After very briefly describing the life-cycle of *Plasmopara viticola* on vine leaves the author states that during 1931 in the vicinity of Bordeaux, rains lasting from 1st to 8th and from 17th to 20th May led to two successive primary infections, conidiophores appearing on affected leaves on 28th May and 9th June, respectively. In an experimental vineyard 48 lots each of 10 Cabernet Sauvignon vines were sprayed once each at intervals of two days, the first lot being sprayed on 4th May and the last on 19th August. On the vines treated before 18th May, on which fewer than seven leaves had as yet appeared, all the leaves developing subsequently to the seventh were exposed to infection arising from the primary

infection of 17th–18th May, though sunny weather in June and July inhibited the spread of the fungus: these vines retained none of their leaves. Rain set in again from 1st August and lasted until September. Those vines which were sprayed once between 20th May and 1st August inclusive kept their leaves and formed fruit clusters, whereas those sprayed once from 3rd August onwards became totally defoliated. Adequate protection throughout the season was secured on the other vines in the vineyard by nine sprayings.

[Pethybridge (G. H.)]. **England and Wales: new and interesting phytopathological records for the year 1931.**—*Internat. Bull. of Plant Protect.*, vi, 2, pp. 21–22, 1932.

The following fungi observed during 1931 are believed to be new records for England and Wales. *Kunkelia nitens* was found on dewberry (*Rubus* sp.) recently introduced from the United States [*R.A.M.*, v, p. 167]. *Chalaropsis thielavioides* was detected on the surface of stored carrots; the pathogenicity of the fungus, which was also found associated with walnut graft failures, is regarded as doubtful. A leaf and fruit spot of strawberries in the west of England was apparently due to *Stagonospora fragariae* [ibid., x, p. 553]. *Agrostis* sp. in an upland meadow in Derbyshire was extensively destroyed by *Sclerotium rhizodes* [ibid., x, p. 776]. The aecidial stage of *Uromyces trifolii* [ibid., viii, p. 176] was detected for the first time on clover, on which the uredo and teleuto stages are not uncommon.

The following are thought to be new British records for the particular hosts involved: *Mycosphaerella pinodes* [ibid., xi, p. 17] on sweet pea; *Gloeosporium album* on quince fruit; and *Sclerotium tuliparum* [see below, p. 460] on corms of *Colchicum* sp.

Salmon (E. S.) & Ware (W. M.). **Mycological Department.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, xxix, pp. 15–22, 1932.

In the late summer of 1931, *Bacterium tumefaciens*, present for several years on cultivated blackberries at Wye [cf. *R.A.M.*, x, p. 116], was conspicuous on the late variety Himalayan Giant not only at ground level but also on the fruiting canes of the current year. The galls were numerous on canes trained 3 or 4 ft. from the ground, and usually they were present at the base of the fruiting laterals. There was some indication that galls appeared also where the canes had been bent or rubbed. Loganberries [*Rubus loganobaccus*] in a plantation which had cropped heavily in 1930 were also attacked [ibid., viii, p. 627], about 100 plants out of 4,000 being killed by May, 1931.

Phellinus cryptarum Karst. was present on the decaying roof timbers of a church at Maidstone, and cricket-bat willows [*Salix caerulea*: ibid., iv, p. 322; vi, p. 520] near Wye showed large branch cankers caused by *Discella carbonacea*.

Onions from near Salisbury were attacked by a fungus closely agreeing with *Heterosporium allii* var. *cepivorum* [ibid., vii, p. 218], which caused light brown spots on the leaves.

Proof was obtained that chlorotic disease of hops [ibid., ix, p. 742]

is transmissible by sap, unlike hop mosaic; experiments demonstrated that the characters of mosaic and the chlorotic disease may be produced in one and the same plant, and that mosaic carriers may be induced to show definite symptoms of mosaic some time after inoculation with the virus from chlorotic hops.

BAUDYŠ (E.). **Fytopathologické poznámky VII.** [Phytopathological notes VII.]—*Ochrana Rostlin*, xi, 6, pp. 178–197, 9 figs., 1931. [German summary.]

In this new series of phytopathological notes [cf. *R.A.M.*, x, p. 295] the author states that a severe form of mosaic, characterized by exaggerated erectness of the foliage, dwarfing, various deformations and spotting of the leaves, and sterility and premature death of the affected plants, was observed in certain varieties of soybeans, a new crop which is being tried in Czecho-Slovakia. The disease is apparently seed-borne, since other varieties growing intermixed with, or in the immediate neighbourhood of the diseased varieties, remained free from the disease, no spread being noticed in the field. In general, mosaic diseases were very prevalent on many crops in 1931 [ibid., xi, p. 258], particularly so on plums, apricots, and peaches, the cultivation of which may even be endangered if no remedial measures are found to check the rapid dissemination of the trouble. On garden and sugar beets a form of mosaic was seen in which the main nerve split at the apex of the leaves, causing a more or less extensive division of the leaf in two.

Lettuce in some localities of Moravia was attacked by two bacterial rots, the first of which affected the heart of the plant, while the second started from the outer leaves and progressed inwards; isolations yielded a species of *Pseudomonas* in the first and a species of *Micrococcus* in the second case. These diseases should be amenable to control by thorough disinfection and ventilation of the hotbeds in which the lettuce seedlings are grown.

The year under review was marked by a considerable development of various species of *Taphrina* on stone fruit trees, particularly numerous witches' brooms having been observed on *Prunus avium* caused by *T. cerasi* [ibid., viii, p. 655] and on plums by *T. insititiae* [ibid., vi, p. 762].

•McRAE (W.). **Report of the Imperial Mycologist.**—*Scient. Repts. Imper. Inst. Agric. Res., Pusa, 1930–31*, pp. 73–86, 1932.

Further studies at the Pusa Agricultural Research Institute, India, on wilt (*Fusarium vasinfectum*) resistance in 'rahar' (*Cajanus indicus*) [*R.A.M.*, x, p. 436 and next abstract] confirmed the superiority of the A.2 (W.R.) type over T.1, the percentages of infection in test rows of which were 1 and 74, respectively. Type A.4 also showed a high degree of resistance to wilt (average of 1·8 per cent. infection in six test plots compared with 63 per cent. in T.1). On a 27-acre field in the regular three-year six-course rotation with pigeon pea once in three years, 20 per cent. of the plants were wilted, and in one patch the percentage reached 55. In a field where no regular rotation is followed and pigeon pea has not been grown for eight years, there were no wilted plants in 11 acres of

six farm selections and 9 acres of A.4. Thus, the known interval of survival of the fungus in the soil has been reduced from ten to eight years. Of the 41,262 plants inspected in the cultivators' fields round Pusa, 2,566 (6·2 per cent.) were found to be wilted. Further experiments to determine the effect of superphosphate on the development of pigeon pea roots confirmed previous observations showing that both the plants and the wilt fungus grow more vigorously under this treatment.

The seed of pigeon pea plants suffering from partial sterility [see next abstract] has been found to produce healthy progeny in two successive seasons, and the injection of leaf juice from diseased into healthy young plants gave negative results.

A *Colletotrichum* attacking pigeon pea at Pusa has been found to agree with *C. cajani* Rangel [ibid., vi, p. 593], and in culture produces an ascigerous stage corresponding in general characters with *Glomerella cingulata*. The leaves and petioles of pigeon pea are further liable to infection by the conidia of a new species of *Cercospora*, two strains of which were observed, one from Allahabad and the other from Pusa. The fungus grows at a temperature range of 6° to 37° C., with an optimum between 27° and 28° in alternate light and darkness. Development occurs from 47 per cent. humidity upwards, but is most profuse at 100 per cent. On a modified Richards's solution the fungus grows between P_H 2 and 9·7, with an optimum at 6·7, all concentrations being reduced to about 2·9 after 45 days.

Mosaic of sugar-cane [ibid., xi, p. 223] was detected on the Co. 302 and 205 varieties, the other 29 Coimbatore varieties, as well as T.U.C. 393 and 472 and P.O.J. 2871, 2878, and 2696 remaining free from the disease. Infection is stated to have been reduced to a minimum by five years' roguing.

Isolated cases of top rot of sugar-cane were observed and a species of *Fusarium* resembling *F. moniliforme* [*Gibberella moniliformis*] was isolated and shown by inoculation experiments to be parasitic [ibid., ix, p. 431]. *Sclerospora sacchari* has not been found on sugar-cane in the field since the previous year [ibid., x, p. 690]. Inoculation experiments with this fungus on maize and *Euchlaena luxurians* gave positive results. Four plants raised from setts of last year's infected cane (found in May) showed the disease in June, 1931.

Inoculation experiments on gram (*Cicer arietinum*) seedlings with a species of *Fusarium* isolated from wilted plants gave positive results, the number of successful infections being higher at 24° to 27° than at 18° to 20°. *Rhizoctonia* [*Corticium*] *solani* and a new species of *Sclerotium* were found together in the collar and roots of gram plants, causing shrinking, cracking, and ultimate death. Both organisms proved to be parasitic. The incidence of *Mystrosporium* leaf blight on gram [ibid., ix, p. 431] was relatively slight, only the T. 68 variety being appreciably damaged. Seed disinfection in 0·5 per cent. formalin was found to kill the spores without impairing germination.

The wheat bunt due to *Tilletia indica* [ibid., x, p. 780] has been found on a number of Punjab x Federation hybrids. The presence of the fungus can only be detected by the examination of the grain

after threshing, and so far little damage appears to be caused. Wheat from different parts of the Punjab was examined by Dr. Mitra in the Lahore market and found to be fairly extensively infected. No bunt developed at Pusa in plants grown from the affected Punjab varieties, and inoculation experiments in the former locality also gave negative results. Freshly collected *T. indica* spores were found to be incapable of germination, which occurred, though poorly, in those eight or nine months old.

Helminthosporium tritici-repentis was far more common on wheat in the Pusa district than *H. sativum* [ibid., x, p. 437]. The varieties most susceptible to both species are P.4 and P.111, while P.12, P.52, P.101, P.163, and country wheats are relatively resistant. *H. teres* caused severe damage on the T.6, T.7, and T.21 barley varieties [ibid., x, p. 233]. Both *H. nodulosum* and *H. leucostylum* cause leaf spot, seedling blight, and head blight of *Eleusine coracana* and *E. aegyptiaca* [ibid., x, p. 437], the former also being responsible for foot and root rot. The temperature range for infection by *H. nodulosum* was found to extend from 10° to 37°, with an optimum at 30° to 32°, and inoculation experiments with it on wheat, oats, barley, maize, sorghum, sugar-cane, *Pennisetum typhoideum*, *Panicum frumentaceum*, and *P. miliaceum* gave positive results.

The *Phytophthora* isolated from *Cinchona* [ibid., ix, p. 431] forms no oospores in pure culture but does so in mixed cultures with *P. colocasiae*, *P. parasitica*, *P. faberi*, or *P. palmivora* [cf. ibid., xi, p. 205]. On the basis of extensive cultural studies the *Phytophthora* isolated from *Piper betle* in Bengal and Madras [ibid., xi, pp. 158, 283] has been found to be *P. parasitica*. The disease may be controlled by the application of Bordeaux mixture $2\frac{1}{2}:2\frac{1}{2}:50$ in areas not exposed to frequent flooding. *C. solani* is spreading on *P. betle* in some areas, where attempts at control with a soil disinfectant are in progress.

The mycelium of a species of *Fusarium* was found in the vascular bundles of the roots, shoots, and petioles of chilli (*Capsicum annuum*) plants suffering from a serious wilt that destroyed the crop before the ripening of the fruits.

The mycelium and sclerotia of *R. bataticola* [*Macrophomina phaseoli*] were found in the rotting tissues of violet plants showing a pale yellow discoloration and curling of the leaf margins and a softening of the root-stock, the cortex of which peeled off readily while the central stele was black and soft.

A species of *Phytophthora* was isolated from *Hibiscus sabdariffa* from Dacca, and an apparently undescribed species of *Alternaria* from tobacco from Rangpur.

Alam (M.). **Appendix 1 (b). Administration Report of the Botanical Section for the year ending the 31st March 1931.** —*Rept. Agric. Dept. Bihar and Orissa for the period from the 1st April 1930 to 31st March 1931*, pp. 42–65, 1931.

The following information of phytopathological interest is included in this report. The Sabour 2 E 'rahar' [*Cajanus indicus*] selection has given great satisfaction both from a general standpoint and also on account of its resistance to wilt [*Fusarium vasin-*

fectum: see preceding abstract], and other pathological conditions, including 'sterility', the cause of which is stated on p. 130 to be still unknown. The incidence and severity of this last disease have been found to vary considerably from year to year and are believed to depend on external factors. Some of the best Sabour types of pigeon pea have been found resistant to sterility and may safely be cultivated on a large scale. A strain from Pusa, almost as prolific as the high yielding Sabour 7S and Pusa P, proved resistant to wilt even on artificial inoculation.

The Sabour 6 selection of linseed has shown a high degree of resistance to wilt [*F. lini*: *R.A.M.*, vii, p. 303], and promising results have been given by hybridization experiments with this strain and the best yielding Pusa types, T. 12 and T. 121.

Van Der Byl (P. A.). **Agriculture in the winter rainfall area. The work of an important institution.**—[*Ex* Annual Report of the Secretary for Agriculture. Year ended 30th June, 1931.] —*Farming in South Africa*, vi, 68, pp. 354–358, 1931.

In connexion with an account of the work of the Stellenbosch-Elsenburg College of Agriculture, mention is made of the detection, for the first time in South Africa, of virus infections on wild mustard or 'ramenas' (*Raphanus raphanistrum*), *Calendula officinalis*, *Tithonia diversifolia*, and granadilla (*Passiflora* sp.). The virus from *R. raphanistrum* has been found to be capable of infecting turnips.

Storey (H. H.). **Report of the Plant Pathologist.**—*Third Ann. Rept. East African Agric. Res. Stat., Amani, 1930–1*, pp. 13–15, 1932.

During the period under review the writer was engaged mainly on the study of virus diseases, especially maize streak [*R.A.M.*, xi, p. 66], while investigations are also in progress, in collaboration with R. Leach, on the problem of 'yellows' of tea in Nyasaland [ibid., x, p. 706]. Brief notes are given on these and other lines of research.

Fiftieth Annual Report of the Ohio Agricultural Experiment Station for the year ended June 30, 1931.—*Ohio Agric. Exper. Stat. Bull.* 497, 201 pp., 23 figs., 4 diags., 14 graphs, 1 map, 1932.

The section of this report on botany and plant pathology (pp. 54–69) contains the following items in addition to those already noticed from other sources. The results of the past three seasons' tests in apple scab [*Venturia inaequalis*] control by H. C. Young indicate that either flotation or mist brand sulphur [cf. *R.A.M.*, ix, p. 796; x, p. 645] is effective during the post-bloom period under fairly severe conditions. A new product, hydrophilic colloidal sulphur [ibid., xi, p. 152], and two dusts, viz., sulphur with finely ground lime-sulphur and manganar-sulphur, also gave excellent control of this disease. H. C. Young and F. Winter found that Brooks's fruit spot of apple [*Mycosphaerella pomi*: ibid., ix, p. 508; x, p. 391, *et passim*] is also amenable to control by hydrophilic colloidal sulphur, as well as by two applications of 1–3–50 Bordeaux

mixture; the latter, however, is apt to cause severe russeting of the fruit.

Good control of gladiolus scab (*Bacterium marginatum*) was given in P. E. Tilford's tests by five minutes' immersion of the corms (mixed and Foch variety) in calomel or calogreen (an extra fine grade of calomel), used at a strength of 1 lb. to 2½ galls. water [ibid., x, p. 438].

In experiments conducted by P. E. Tilford to determine the effect of increasing the lime content of Bordeaux mixture (to induce cooling of the leaves) on the yield of sprayed potatoes [ibid., ix, p. 258]. it was found that the plants treated at the rate of 4–12–50 produced 432·3 bushels per acre compared with 406·4 and 352·3 for the plots receiving 4–9–50 and 4–6–50 Bordeaux mixture, respectively [ibid., ix, p. 258].

J. D. Wilson found that copper-lime mixtures gave better control of bacterial wilt of cucumbers [*Bacillus tracheiphilus*: ibid., x, p. 500] than lime-lead arsenate or gypsum-calcium arsenate dusts, but since the latter caused less stunting the final yields were higher in the plots on which they were used.

The best control of tomato leaf mould (*Cladosporium fulvum*) in greenhouse trials by L. J. Alexander was given by five or six weekly applications of hydrophilic colloidal sulphur (4 lb. to 100 galls. water), beginning about 10th September.

The following procedure was found by H. F. Winter to be effective against crown gall [*Bacterium tumefaciens*] of black raspberries [*Rubus occidentalis*: ibid., x, p. 116]. Healthy stock should be planted on land that has not grown brambles, vines, fruit, or nursery stock for the past five years. The plantings should be inspected when the old canes are removed, diseased plants rogued out, and the soil disinfected with formaldehyde (1 pint to 6 galls. water) applied at the rate of ½ gall. per sq. ft. of soil surface. The causal organism may be carried on pruning tools, farm implements which should be disinfected in 1 in 1,000 corrosive sublimate, by human and animal agency, and by drainage water. Inspections were made of approximately 90 acres of black raspberries belonging to 32 growers that had been inspected and rogued since 1925 and kept isolated in various places in Ohio in connexion with the virus disease control project [ibid., xi, p. 381]. The total number of virus-diseased plants was found to be 0·68 per cent. in the Cumberlands and 0·17 per cent. in the Plum Farmers.

In the course of studies by R. C. Thomas on the structure of the hyphae of *Pythium ultimum* the action of basic dyes (thionin and resorcin blue) gave strong evidence of the presence of an acidic carbohydrate similar to that found in *Sclerotinia* and designated as callose, while treatment with alcoholic potash showed that a certain amount of cellulose was also present.

In a preliminary test by R. C. Thomas on the action of organic mercury compounds on plant and human pathogens, the former group comprising *Phytomonas* [*Bact.*] *pruni*, *P.* [*Bact.*] *tumefaciens*, *Erwinia amylovora* [*B. amylovorus*], and a bacterium causing wilt of sweet clover (*Melilotus alba*), a calculation of the phenol coefficients of the dilutions of metaphen and merthiolate

killing these organisms at 2½- and 15-minute intervals indicated the superiority of the former in every case.

Agricultural Research in New Hampshire.—Annual Report of the Director of the New Hampshire Agricultural Experiment Station for the year 1930.—*New Hampshire Agric. Exper. Stat. Bull.* 256, 27 pp., 8 figs., 1931. [Received May, 1932.]

The following items of phytopathological interest occur in this report (p. 16). O. Butler found that temperature is largely responsible for the difference in behaviour of potato diseases in northern and southern New Hampshire. Healthy plants and those affected by mosaic and leaf roll were grown in the greenhouse (*a*) at a mean temperature closely approximating to that of the certified seed-producing (northern) area of the State, and (*b*) at a mean temperature close to that of southern New Hampshire. According to expectation, the mosaic plants grown at the higher temperature showed only mild or obscure symptoms, while those at the lower temperature were conspicuously affected. The typical leaf roll symptoms were also more apparent at the low than at the high temperature [cf. *R.A.M.*, viii, p. 552]. The average number of tubers per plant was not affected by temperature, but the yield of the diseased plants was better at the higher temperature, the reverse being the case with healthy ones.

The same worker found that scorching of foliage follows the use of a 1 per cent. Burgundy mixture in which the proportion of copper sulphate to sodium carbonate is increased to 1:0·5. Mixtures of 1:1 and 1:1·5 produced no injury on beans [*Phaseolus vulgaris*], while very slight damage was caused by one of 1:1·84. With apples the appearance of injury was delayed by increasing the amount of sodium carbonate, though eventually the total amount of damage was much the same for all the mixtures tested except the most harmful, 1:0·5. Further experiments on the prevention of deterioration in Burgundy mixture showed that the addition of citric or tartaric acid (preferably the former) to an acid mixture, becoming neutral on standing, will ensure keeping for an indefinite period.

Heald (F. D.). **Division of Plant Pathology.**—*Forty-first Ann. Rept. Washington Agric. Exper. Stat. for the fiscal year ended June 30, 1931* (*Bull.* 260), pp. 47–50, 1931.

Some of the items in this report have already been noticed from other sources. The following are amongst the diseases reported for the first time from the State of Washington: fruit rot of pears (*Phytophthora cactorum*) [*R.A.M.*, xi, p. 111]; leaf blight or cast of Douglas fir [*Pseudotsuga taxifolia*] in the Blue Mountains, caused by *Rhabdocline pseudotsugae* [ibid., ix, p. 617]; a very severe damping-off and blight of sweet clover [*Melilotus alba*] at the Experiment Station due to an undetermined species of *Pythium*; early rot or blast of cranberries (*Guignardia vaccinii*) [ibid., xi, p. 188] in Grays Harbor; artichoke [*Cynara scolymus*] wilt (*Sclerotinia sclerotiorum*); and leaf spot of lily (*Botrytis elliptica*) [ibid., xi, p. 243].

Mosaic of iris [ibid., x, p. 162] has been reported as prevalent and severe in several coastal areas, while a disease of rhubarb, possibly due to the beet curly top virus, has been observed both east and west of the Cascades. *Fusarium* wilt of peas [*F. orthoceras* var. *pisi*: ibid., xi, p. 86] is apparently becoming more prevalent in the seed-producing area of eastern Washington, where a study of varietal resistance and other phases of the disease has been initiated.

Botany.—*Forty-fourth Ann. Rept. Georgia Exper. Stat. for the year 1931*, pp. 33–36, 1 col. pl. (opposite p. 28), 1931.

Owing to extremely dry weather during the autumn, the pimento pepper [*Capsicum annuum*] crop sustained little injury from ripe rot (*Vermicularia capsici*) [*R.A.M.*, x, p. 57], which has been found to overwinter on decayed fruits left in the field. This débris and infected seed appear to be the principal sources of spring infection.

Further studies on cotton root disease (*Fusarium moniliforme*) [*Gibberella moniliformis*: ibid., ix, p. 436] showed that certain dusts are very effective in the control of the causal organism and in augmenting the yield of the crop, besides being cheaper and more convenient than the delint-soak method of seed disinfection. The following preparations were tested, all at the rate of 4 oz. per bushel: ceresan, Du Bay 971 A, Du Bay 965 D, Du Bay 971 C, Ansbacher-Siegle No. 14, and 20 per cent. mercuric chloride dust, one plot being left untreated and another planted with delinted seed soaked in mercuric chloride solution (1 in 1,000) for 20 minutes. The best results were given by ceresan and Du Bay 965 D, the yields of the early and late sowings in the plot treated with the former being 1,236 and 1,536 lb. per acre, respectively, and for the latter 1,260 and 1,428 lb., compared with 1,092 and 1,344 lb. for the control and 1,212 and 1,440 lb. for the plot treated by the delint-soak method. The other dusts also gave increased yields in comparison with the controls.

The Spanish peanut, the common variety in Georgia, has been found highly susceptible to leaf spot (*Cercospora personata*), to which the runner types (Virginia and Carolina Runner) are quite resistant.

Temperatures between 15° and 27° C. appear to favour the development of peach rosette in inoculated trees [ibid., xi, p. 356].

Very good results in the control of downy mildew of cantaloupes [*Pseudoperonospora cubensis*: ibid., x, p. 500] were given by a Bordeaux mixture with a high lime content (3–9–50), which augmented the yield without causing spray injury.

Palm (B.). **Pflanzenkrankheiten aus Guatemala.** [Plant diseases from Guatemala.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xlii, 1, pp. 11–17, 1932.

An annotated list is given of the plant diseases (excluding those due to viruses, which will be described elsewhere) observed by the writer during his four years' residence in Guatemala. Groundnuts are attacked by *Septogloeum arachidis* [*Cercospora personata*:

R.A.M., ii, p. 351 ; xi, p. 20] and *Sclerotium rolfsii*, the former causing a reduction of yield when the crop is interplanted with rice and maize.

Chilli (*Capsicum annuum*) is liable to extensive infection by mildew (*Oidium* sp.) and appears to be almost constantly affected by mosaic [ibid., x, p. 809].

Coffee is widely attacked by *Cercospora coffeae* Zimm., which seldom, however, causes appreciable damage. *Corticium koleroga* is much in evidence, its development and spread apparently being promoted by too dense planting and the overhung shape of the trees. The most serious disease of coffee in Guatemala, however, is that caused by *Omphalia flavida* [ibid., viii, p. 378], the *Stilbella* stage of which is found on a number of common plantation weeds, e.g., *Borrera* sp., *Commelina* sp., and *Cleome* sp., as well as on the shade trees, *Inga* sp. and *Musa* sp. The control of *O. flavida* should be based, in the first instance, on a rational system of weed eradication.

The most important disease of cotton in Guatemala is that caused by *Bacterium malvacearum*.

Cacao suffers heavy damage from *Phytophthora faberi* [*P. palmivora*], which is thought to be partially responsible for the extremely low yield of beans per acre (300 lb. or less).

Tobacco is infected by *Botrytis cinerea*, *Cercospora nicotianae*, *Oidium tabaci* [*Erysiphe cichoracearum*], and *P. nicotianae*, the last-named causing very heavy damage on the plateau.

Tomatoes growing under unfavourable conditions may be severely attacked by *Septoria lycopersici* and *P. infestans*.

Gloeosporium mangiferae is prevalent on mango trees in the coastal regions, especially during the rainy season [ibid., vii, p. 305], when almost all the inflorescences may be attacked, the foliage being less affected.

Uromyces appendiculatus [ibid., x, p. 775] causes severe and extensive damage to beans [*Phaseolus vulgaris*], one of the staple native food crops. The same host is also liable to infection by *C. canescens* [ibid., vii, p. 538 ; viii, p. 66] and *Isariopsis griseola* [ibid., x, pp. 83, 775], the former being particularly severe at high altitudes. *Uromyces fabae* occurs on broad beans (*Vicia faba*) [ibid., vii, p. 558].

Late blight of potatoes (*Phytophthora infestans*) has been observed over the entire plateau, where it constitutes the limiting factor to the cultivation of this crop.

Ricinus communis, extensively planted by the natives and also growing wild, is heavily infected during the rains by a *Botrytis*, probably *B. cinerea*, which often causes complete defoliation.

Gibberella saubinetii occurs on maize throughout Guatemala ; the fungus appears to cause little injury to the cobs but plays an important part in the etiology of seedling blight. *Physoderma zeae-maydis* and *Puccinia maydis* [*P. zeae*] have both been observed on maize but appear to be of slight importance. *Ustilago zeae* causes no appreciable damage to maize along the coast, but on the plateau, where the crop has been cultivated for centuries in biennial rotation with wheat or beans, it may reduce the yield by as much as 20 per cent.

BARAT (H.). **Études de la Division de Phytopathologie (Section Sud-Indochinoise de l'Institut des Recherches agronomiques) au cours de l'année 1930. II. Laboratoire de cryptogamie.** [Studies of the Phytopathological Division (South Indo-Chinese section of the Agricultural Research Institute) in the course of the year 1930. II. Cryptogamic laboratory.]—*Bull. Écon. Indochine*, N.S., xxxiv, pp. 779 B–796 B, September, 1931.

A series of epidemics marked the period under review, more especially among the coffee plantations of Annam and the rice fields of Cochin-China. Coffee was attacked by *Corticium* [*salmonicolor*: *R.A.M.*, x, p. 788] and *Colletotrichum coffeanum* [*Glomerella cingulata*: ibid., xi, pp. 159, 368, 370], the latter being particularly severe in Cochin-China, where it causes an extensive die-back of the plants from the upper part downwards.

A bacterial disease of the pseudo-stem of the Chuôi sù banana was observed in the Phan-Thiêt district. It was said to attack no other variety and to be less severe than the other bacterial diseases of the banana described elsewhere.

Sugar-cane is liable to the following diseases: smut (*Ustilago sacchari*) [*U. scitaminea*], which is more serious on the Formosa canes and those of the *Saccharum sinense* group than on the Bourbon and P.O.J. varieties; red rot (*C. falcatum*); 'banded sclerotial disease' [*Sclerotium* sp.: ibid., vii, p. 600 *et passim*], which occurred in a severe form in some late planted plots at the onset of the rainy season but was rapidly arrested with the onset of sunny weather; and red rot of the leaf sheaths [*S. rolfsii*: ibid., ix, p. 808], which only attacks the lowest four or five leaves and may thus be controlled by stripping the lower leaves. In one plantation in the province of Biên-Hoa the canes (imported from Java) suffered from a form of top rot associated with the presence of unidentified bacteria and of a species of *Fusarium*, probably *F. moniliforme* [*Gibberella moniliformis*], the causal organism of pokkah-boeng. *Coniothyrium sacchari* was found on canes harvested unduly late in the season.

Hevea rubber was affected by brown rot associated with forms of *Poria* and the incipient fructifications of a fungus probably identical with *Fomes lamaoensis* [ibid., xi, p. 72], but very few trees (1 in 10,000) were actually killed. *Sphaerostilbe repens* [ibid., ix, p. 405] was found in the plantings of budded stumps originating in Sumatra, which were placed in quarantine. This disease not having yet been reported in Indo-China, orders were given to burn the infected material and disinfect the soil. Brown bast was very prevalent, especially in old plantations. None of the treatments tried against this disease having proved economically feasible, the sole method of control is to leave the trees untapped for periods of six months to a year. Stripe canker [*Phytophthora* sp.: ibid., ix, p. 405] was also widespread but readily controlled. Numerous cases of die-back of rubber were observed, associated with *Gloeosporium albo-rubrum* [ibid., ix, p. 200], *Botryodiplodia theobromae* [ibid., ix, pp. 405, 675], and *Fusarium* sp. An account is given of the symptoms of a 'collar' disease of rubber grafts associated with *B. theobromae* which caused losses up

to 40 per cent. in 1930 [loc. cit.]. The disease presents close analogies with the 'sun scorch' of the lateral roots described by Sharples from Malaya [ibid., v, p. 761], and may be readily controlled by shading combined with irrigation. The multiplication and hypertrophy of the lenticels characterizing one phase of the disease appear to be connected with the presence of a *Glocosporium*. A violent outbreak of the leaf disease due to *Helminthosporium heveae* [ibid., x, p. 685] was occasioned by the cold rains of December in nursery plantings.

Cinchona seedlings showing only the two cotyledonary leaves were attacked by a *Fusarium* which was apparently carried on the seed. *Rosellinia* sp. was found in the cracks on the collar and roots of one- to two-year-old *Cinchona* plants [ibid., ix, p. 161] on impermeable soil.

Rice suffered heavy damage from the attacks of *Sclerotium oryzae* [ibid., xi, p. 159] and *H. oryzae* [ibid., x, p. 759], the latter following the late, cold rains of December.

An epidemic of blister blight of tea (*Exobasidium vexans*) [ibid., ix, p. 144] occurred in the Kontum district. 'Scabbed leaf', characterized by the appearance on the upper leaf surfaces of tea of black (later grey), irregular spots, is believed to be due to an undetermined fungus, the mycelium of which disorganizes the palisade tissue.

STELL (F.). **Witch-broom disease of Cacao.**—*Proc. Agric. Soc. Trinidad and Tobago*, xxxii, 1, pp. 23–31, 1932.

Counts made on 26 representative estates in different parts of Trinidad and comprising an area of some 10,000 acres, bearing three million cacao trees, showed that in 1929 the number of trees infected by *Marasmius perniciosus* [*R.A.M.*, x, p. 658] was 6,080, in 1930 the figure was 18,078, and in 1931 it had risen to 58,000 or 2 per cent. of the whole. The disease is now present all over the island, having been reported on some 100,000 acres or half the total acreage under the crop.

A diseased twig or cushion or pod can produce eventually, if not destroyed, over one hundred mushrooms, each of which gives rise to between 20 and 30 million spores. Observations continued throughout one year on the experimental Marper estate (93 acres) in one of the most severely affected areas of the island showed that on an average three weeks elapse before brooms in the fresh, green stage become dry and brown, and that at least 14 weeks are required from its formation before the broom begins to produce sporophores. The broom may remain in position for 4 to 18 months or longer, producing successive crops of mushrooms. The main flushing period of cacao in Trinidad is in February and March, during which period the brooms are most numerous; later, but at periods varying with the year, the dry Indian summer, which also varies in duration, sets in, and the flush during this period is also accompanied by increased infection. Other minor flushes also occur annually, and are complicating factors.

In two complete working years, 1928 and 1931, the control of removing and destroying witches' brooms on the Marper estate

worked out at 6·8 dollars [= approximately £1 8*s.* 4*d.*] per acre. Lest this should be regarded as excessive the author points out that in Ecuador, where control is impracticable, *M. perniciosus* and *Monilia* [ibid., vi, p. 660; see also iv, p. 149] have in 10 or 12 years reduced the crop by fully 50 per cent.

At Marper, after two full years' eradication work, the number of sporophores found in December, 1931, averaged 2 per acre, whereas in a neighbouring plantation 610 per acre were found. Reinfection from outside is, thus, likely to complicate the control measures.

BAMBER (R. H.). **The pathogenicity of Bacterium translucens var. undulosum.**—Abs. in *Phytopath.*, xxii, 1, p. 4, 1932.

Bacterium translucens var. *undulosum* [*R.A.M.*, xi, p. 163] has been found to infect oats, *Hordeum jubatum*, and *Bromus inermis* in addition to wheat, spelt, barley, and rye in Minnesota. Cultures obtained from rye and barley readily produced the typical black chaff lesions on wheat seedlings, the incubation period being 48 hours at 24° C. and 20 days at 10°. In the field in 1931, wheat plants were easily infected early and late in the growing season but not at midsummer. Wheat plants inoculated at the boot stage contracted infection on the leaves, awns, glumes, rachids, and necks. Infected areas on greenhouse plants became typically black, while most of those of plants kept at 10° and 20°, under artificial light, remained yellowish and water soaked. Four variants arising as sectors in cultures of the black chaff organism differed from the parents both culturally and in pathogenicity.

VANTERPOOL (T. C.) & TRUSCOTT (J. H. L.). **Studies on browning root rot of cereals. II. Some parasitic species of Pythium and their relation to the disease.**—*Canadian Journ. of Res.*, vi, 1, pp. 68–93, 2 pl., 8 figs., 1932.

Continued investigation of the root rot of cereals in Saskatchewan [*R.A.M.*, ix, p. 581] showed that, as indicated by the preliminary results, the condition is primarily due to the parasitic activity of certain species of *Pythium*, the more aggressive forms of which belong to the *Nematosporangium* group [ibid., xi, p. 129] of the genus, while the *Sphaerosporangium* forms are of little consequence. The most important of the parasitic species are a form considered to be new to science, which is named *P. volutum*; and another which, on the ground of its morphological details and pathogenic capacities, is provisionally identified as a variety of *P. arrhenomanes* [ibid., x, p. 180], *P. arrhenomanes* var. *canadensis* n. var. The latter was shown by comparative morphological, physiological, and pathological studies to be closely related to the Louisiana species causing a root rot of sugar-cane [ibid., viii, p. 740; ix, p. 271]. English diagnoses of these two organisms are given.

Of the two, *P. arrhenomanes* var. *canadensis* is the most widely distributed on wheat in Saskatchewan. When growing actively in the host tissues it produces terminal or intercalary, lobulate

sporangia, ranging from toruloid lateral buds to compound complexes, and provided with a discharge tube measuring up to 150 by 3 to 5 μ; discharge tubes are seldom formed on solid media but often in liquid ones. The zoospores, which vary in number from 5 to over 50 in a vesicle, are biciliate, deeply grooved at the hilum region, and measure about 12 μ when rounded up; they are monoplanetic and germinate by a single germ-tube. The oogonia are spherical to subspherical, terminal (rarely intercalary), the majority 27 to 40 μ diameter (average 33 μ) on carrot-cornmeal agar; in liquid cultures a bulbous swelling occasionally forms on the oogonial stalk near the oogonium. The antheridia are characteristically crook-necked, geniculate, or clavate; most commonly there are 3 to 6 antheridia to one oogonium, but as many as 12 have been counted, usually arising from neighbouring hypnae. The oospores are smooth, spherical to subspherical, light brown, usually completely filling the oogonium, and their average diameter is 31 μ. Controlled experiments indicated that this species may be as vigorous a parasite of wheat seedlings as *Helminthosporium sativum* or *Ophiobolus graminis*, and is much more aggressive than *Fusarium culmorum*. It was also shown to be capable of aggressive attack on the roots of oats, barley, rye, and maize.

P. volutum is apparently restricted to the Tisdale district in the park land and the Regina plains in the south. It has never been observed to form lobulate sporangia on solid media, but some were very occasionally seen in liquid media as lateral outgrowths or buds from the hyphae. The zoospores, which are not readily discharged, are biflagellate, bean-shaped, and 10 to 14 μ in diameter. The oogonia are smooth, subspherical, dark brown, terminal on short side stalks (rarely intercalary), and their average diameter is 30 μ. The antheridia (3 to 10 to each oogonium) are crook-necked, or sometimes curved or even straight, usually arising from adjacent hyphae or more rarely from the oogonial stalk. The oospores are smooth, spherical to oblong, usually free within the oogonium, and average 27·7 μ in diameter. In nature this species occurs on wheat and oats, and it was experimentally shown to be capable of parasitizing the roots of barley, rye, and maize.

Tests with *P. graminicolum* [ibid., viii, p. 34] from sugar-cane roots (received from Drechsler) showed that this species is only slightly parasitic on Marquis wheat.

The investigation indicated further that soil conditions (especially those following summer fallow) and seasonal climatic factors have a considerable influence on the incidence and severity of the root rot caused by these species of *Pythium*. Under experimental conditions the injury caused by them manifested itself as an embryo rot or pre-emergence killing of the cereal seedlings, post-emergence blight, or as retarded development throughout the life of the hosts. Both winter and spring wheats were shown to be susceptible. The damage caused to young wheat plants by *P. arrhenomanes* var. *canadensis* increased with increasing soil temperatures and moistures. No correlation was found between the hydrogen-ion concentration of the soil and the distribution of the disease, and no conclusive results have as yet been obtained as

to the effect of various fertilizers on the disease under controlled conditions.

PETIT (A.). **De la transmission des rouilles des céréales en Tunisie.** [On the transmission of cereal rusts in Tunis.]—*Ann. du Service Bot. de Tunisie,* vii, p. 111–130, 1 pl., 1931.

In Tunis the wheat rusts (*Puccinia* spp.) appear annually between 15th March and 1st April. No evidence has been found that the alternate hosts play any part in the development of rust on the cultivated cereals, and wheat protected from contact with dust in the atmosphere was never infected in the author's experiments, though the plants retained their susceptibility throughout growth and during all seasons. Plants grown from seed taken from wheat not rusted the previous year became infected directly they were placed in the open, while wheat grown in sterilized soil isolated from the outside atmosphere did not become infected. Uredospores and straw bearing sori were buried in soil in June and examined the following February, when none of the spores germinated. Heavy applications of cupric salts to the soil did not prevent the development of rust so long as the plants were exposed to the air. Sori bearing uredospores were noted on volunteer plants long before being seen in cereal fields; *P. graminis avenae* and *P. coronata* [*P. lolii*] were present on volunteer plants of cultivated oats one month after sowing. Spore traps exposed well before the appearance of rust in the field were found occasionally to catch spores resembling the uredospores of the cereal rusts. These are thought to have come from straw heaps in the neighbourhood. Rust was permanently present in wet localities where volunteer plants grew successively throughout the year, if during the spring the plants had borne uredospores. Stools of a highly susceptible variety were often severely rusted when others of the same variety, sown at the same time and in the same conditions except that they were sheltered from the wind, remained healthy if remote from foci of infection.

The author concludes that the cereal rusts are air-borne in Tunis and that uredospore infection chiefly from volunteer plants is an initial cause of an outbreak.

STAKMAN (E. C.), HINES (L.), UKKELBERG (H. G.), & BUTLER (W.). **Distribution of physiologic forms of Puccinia graminis tritici in the United States and Mexico in relation to rust epidemiology.**—Abs. in *Phytopath.*, xxii, 1, p. 25, 1932.

From 1929 to 1931, inclusive, 27 physiologic forms of *Puccinia graminis* [var.] *tritici* have been identified from about 1,650 collections made in the United States and Mexico [*R.A.M.*, ix, p. 233]. Forms 11, 21, 36, 38, and 49 were by far the most prevalent (average almost 90 per cent. of all collections) in each of the three years. Forms 49 and 38 were abundant in Mexico, the latter, which is only weakly pathogenic to the hard red spring wheats, constituting some 65 per cent. of all collections. On the other hand, forms 11, 21, and 36 were of very rare occurrence in Mexico. All these five forms were fairly widespread in the spring

in Texas, where some of them apparently overwintered in the uredo stage. The data from spore-trap exposures and observations on the northward spread of rust indicate that uredospores of these forms were carried northward from Texas by high winds. Abundant evidence is also available that much inoculum originated on barberries in the northern States [see next abstract].

WALLACE (J. M.). **Physiologic specialization as a factor in the epiphytology of Puccinia graminis tritici.**—*Phytopath.*, xxii, 2, pp. 105–142, 1 diag., 3 maps, 1932.

Much of the information in this amplified and fully tabulated account of the surveys made by the writer and his colleagues in 1926, 1927, and 1928 of the prevalence and distribution of physiologic forms of *Puccinia graminis tritici* in the United States has already been published [see preceding abstract *et passim*]. In 1926 the loss from black rust was insignificant and there was little evidence of south to north migration of forms affecting wheat, but in 1927 over 30 million bushels were destroyed by an epidemic in the spring wheat region, forms 18 and 21 being generally distributed in the northern Mississippi Valley and being also exceedingly common in Texas earlier in the season. In 1928 the incidence of infection was again much reduced, the total loss in the 13 barberry eradication States amounting to only 1⅓ million bushels: form 38, which appears to have originated in Mexico, was the most prevalent southern form. Attention is drawn to the value of such surveys in the study of the epiphytology of stem rust of wheat, the importance of an investigation of aecidial infections to supplement the field collections of uredospore material being emphasized. Fairly definite evidence has been obtained in recent surveys of the existence in the northern United States and Canada of certain physiologic forms probably perpetuated exclusively by means of barberries [see next abstract].

STAKMAN (E. C.), HINES (L.), COTTER (R. U.), & LEVINE (M. N.). **Physiologic forms of Puccinia graminis produced on Barberries in nature.**—Abs. in *Phytopath.*, xxii, 1, p. 25, 1932.

Many new physiologic forms of *Puccinia graminis* have been produced experimentally by hybridization between existing forms, and many segregates from certain 'selfed' heterozygous forms have been isolated from aecidia [*R.A.M.*, x, p. 365]. Presumably hybridization on barberries also occurs in nature. A survey was therefore made of varieties and physiologic forms of the rust occurring on barberries and neighbouring Gramineae with primary infection. All North American races or varieties of *P. graminis*, except *phlei pratensis*, develop readily on barberries, the following isolations having been made: 7 forms of *P. graminis secalis*; 17 of *P. graminis tritici*, of which 4 were previously unknown though one was subsequently found on wheat; and 3 of *P. graminis avenae*, of which one (form 8) has been found only on oats near barberry. New physiologic forms are evidently in course of production on barberries in nature, and since mutation in pathogenicity of *P. graminis* seems rare, barberry is apparently primarily responsible for the origin of these new forms.

NEATBY (K. W.). **Factor relations in Wheat for resistance to groups of physiologic forms of Puccinia graminis tritici.**—*Scient. Agric.*, xii, 2, pp. 130–154, 9 figs., 1931.

A full account is given of investigations carried out at Winnipeg to study the reaction of wheat hybrids to physiologic forms of *Puccinia graminis tritici* [see preceding abstracts] in order to ascertain (1) how many of these forms might be contained in a single group, the reaction to which appeared to be governed by a single factor pair; (2) to what extent a group identified in one cross might be found intact in another; and (3) to study the importance of such groups identified in the greenhouse in relation to field reaction.

The results obtained [which are tabulated and discussed] showed that the fifteen physiologic forms of *P. graminis tritici* the reactions to which of the cross Marquis × H–44–24 were studied fell into three groups, containing, respectively, seven, five, and three forms. Two sets of genetic factors were identified, one affecting the reactions to the forms in groups I and II, and a second affecting the reactions to the forms of groups I and III. Thus, the reactions of the cross to groups II and III are apparently controlled by a single set of factors, one for each group, while reaction to group I is affected by both sets of factors. In view of the results obtained by other workers with this cross [cf. *R.A.M.*, viii, p. 29] the author considers that each of the two sets of factors consists of only one pair.

In a study of Marquillo × H–44–24 fourteen physiologic forms were used, one set of factors being found to affect the reactions to all, but only two of the forms (group I) being, apparently, governed solely by these factors. A second set of factors affected the reactions to ten forms, which constitute group II. The reaction to form 29 was governed by the factors concerned in the reactions to the forms of group I plus an additional set of factors which may possibly be identical with some of the second set of factors concerned in the reaction to group II, or may constitute a third set. In Marquillo × H–44 24 the grouping of the forms was quite different from the grouping in the cross Marquis × H–44–24. No conclusion with regard to the number of factor pairs included in each set in the former could be drawn.

In the cross Garnet × Double Cross three groups of forms were identified, one containing five forms and the two others each containing two; the reactions were governed by two sets of factors, one affecting the reactions to the forms of groups I and III, and the second affecting those to the forms of groups II and III.

Experiments made to determine the effect of the factors concerned in the reaction of seedlings in the greenhouse in the resistance to stem rust in the field showed that selection on the basis of seedling reaction in the greenhouse was useless so far as Marquis × H–44–24 was concerned. With Marquillo × H–44–24, however, the factors governing the seedling reaction in the greenhouse were expressed in the field reaction. The results obtained from a field study of Garnet × Double Cross indicated that the factors concerned in the seedling reactions in the greenhouse did affect the field reactions in this cross, though the degree of the relationship

between the field and the greenhouse reactions could not be determined from the data available.

HARRINGTON (J. B.). **Predicting the value of a cross from an F_2 analysis.**—*Canadian Journ. of Res.*, vi, 1, pp. 21–37, 3 graphs, 1932.

The author states that as a result of extensive breeding work, in which he attempted to combine the [illegible] rust (*Puccinia graminis tritici*) resistance of Marquillo wheat with the many desirable agricultural qualities of the rust-susceptible Marquis [cf. *R.A.M.*, viii, p. 29], from an initial F_2 population of about 40,000 plants, only six lines remained in the F_6 generation which showed a promise of achieving the desired combination, and none of these lines was entirely satisfactory. This disappointing result led him to investigate the possibility of predicting the final value of a cross by a detailed analysis of the behaviour of individual plants in the F_2 generation, for which purpose he used a remaining lot of F_2 grain of the Marquillo × Marquis cross. The figures obtained by the statistical method [some details of which are given] in this study agreed well with those that were observed during the long and laborious practical work, indicating the advisability of subjecting a preliminary population of several hundred F_2 plants to critical analysis for all important characters before undertaking extensive work on a cross. The study also indicated that genetic linkage may be concerned with respect to factors governing rust reaction, seed appearance, and crumb colour.

PETERSON (R. F.). **Stomatal behaviour in relation to the breeding of Wheat for resistance to stem rust.**—*Scient. Agric.*, xii, 3, pp. 155–173, 4 figs., 1931.

Leaves of seven [named] standard susceptible and resistant varieties of wheat as well as of susceptible and resistant hybrids from H–44 × Reward and H–44 × Renfrew were studied microscopically in the field at Winnipeg to ascertain whether the rate of stomatal opening in the morning is correlated with the amount of infection by *Puccinia graminis tritici* [cf. *R.A.M.*, ix, p. 295]. It was observed that while the standard varieties showed some differences in their stomatal behaviour these differences were insufficient to account for the variations in rust reaction and some did not bear out the functional resistance theory [loc. cit.], the stomata of the two durum varieties Pentad and Mindum, for example, at comparable stages of growth, behaving alike, although Pentad is resistant and Mindum susceptible. Only slight differences in stomatal behaviour were noted as between the different hybrid strains, and these appeared to be unrelated to rust reaction.

Marquis and H–44 plants inoculated with *P. graminis tritici* form 9 and incubated in the dark showed marked differences in their respective rust reactions. These differences, being independent of the stimulus of light, were not due to functional resistance. The type of reaction shown by H–44 indicated that this variety possesses in the heading stage a physiologic resistance to form 9 which it does not possess in the seedling stage.

When hybrids of H–44 × Marquis and Pentad × Marquis were

sprayed with soft water in the morning to prolong the dew period, the amount of infection was not increased.

It is concluded that the main resistance of H–44, Hope, and Pentad wheats is not due to stomatal behaviour.

Caldwell (R. M.) & Stone (G. M.). **Appressorium formation and penetration by leaf rust of Wheat, Puccinia triticina, in relation to stomatal aperture.**—Abs. in *Phytopath.*, xxii, 1, pp. 5–6, 1932.

By stripping the epidermis from wheat seedling leaves inoculated with leaf rust (*Puccinia triticina*) [*R.A.M.*, xi, p. 231], fixing, staining, and mounting it in absolute alcohol, the relation of the stomatal aperture at the time of penetration to the entrance of the fungus into the host may be directly observed. The formation of an appressorium over an open stoma apparently stimulates it to close tightly, but the closed stomata offer no impediment to penetration and on the living plants a small stomatal slit may often be seen between the appressorium and the substomatal vesicle, apparently caused by the penetration tube pushing between the guard cells.

On inoculation on wheat leaves, *Uromyces fallens* [ibid., viii, p. 176] penetrated abundantly and behaved identically with *P. triticina* in relation to the stomata.

Caldwell (R. M.), Kraybill (H. R.), Sullivan (J. T.), & Compton (L. E.). **The effect of leaf rust, Puccinia triticina, on the composition and yield of winter Wheats in 1931.**—Abs. in *Phytopath.*, xxii, 1, p. 5, 1932.

Yield data and chemical analyses of the plants and grain were secured from replicated plots of severely leaf-rusted (with *Puccinia triticina*) and nearly rust-free winter wheats of eight varieties at La Fayette, Indiana, in 1931. Practically rust-free control plants were obtained by sulphur dusting. The rusted plots consistently yielded a lower protein content and much less vitreous grain than the controls, but the vegetative portions of the rusted plants were higher in total nitrogen. The latter were lower in reducing sugars, sucrose, and starch. Significant reductions in yield of grain and straw, test weight per bushel, weight of 1,000 kernels, and number of kernels to the head were observed in the diseased plots. In the susceptible Michigan Amber variety, where four degrees of rust severity were secured by variations in the dusting procedure, the above-mentioned trends were evidenced in approximate proportion to the incidence of infection.

Flor (H. H.). **Heterothallism and hybridization in Tilletia tritici and T. levis.**—*Journ. Agric. Res.*, xliv, 1, pp. 49–58, 1932.

Continued experiments on the lines indicated in a previous communication [*R.A.M.*, x, p. 372] are stated to have definitely established that both *Tilletia tritici* and *T. levis* [*T. caries* and *T. foetens*] are heterothallic. The tests included three physiological forms of *T. caries* and two of *T. foetens* [cf. ibid., xi, p. 33] which were shown to comprise an as yet undetermined number of sex

groups. The members of these groups are specific, for in no instance was a member of one group able to cause infection of the wheat seedlings when paired with a member of a similar group. It is pointed out, however, that membership within a sex group was not confined to a particular physiological form or even to the respective species, since compatible sex groups of *T. caries* and *T. foetens* readily paired with each other, thus providing ample opportunity for hybridization in nature. The spores produced by this species-cross were identical in appearance with those of *T. foetens*: they were ellipsoidal and slightly angular in shape, and their epispore wall was smooth. The investigation also provided evidence that by adequately pairing the monosporidial cultures of these fungi it should be possible to develop pathogenically pure lines of both species.

Dounine (M. S.) & Simsky (A. M.). **Haftfähigkeit der Trockenbeizmittel.** [Adhesiveness of dusts.]—*Angew. Bot.*, xiv, 1, pp. 33–78, 1932.

A detailed and fully tabulated account is given of the writers' experiments to determine the adhesiveness to cereal seeds of a number of dusts, viz., $NaAs_2O_3$, $CaAs_2O_3$, Paris green, potassium bichromate, copper carbonate, and malachite [cf. *R.A.M.*, x, pp. 228, 475]. The adhesiveness of the preparations was determined mainly by Hilgendorff's method [ibid., ix, p. 707] or modifications of this, and was found to bear a relation to their specific gravity, being greatest in those with a relatively low specific gravity, e.g., $NaAs_2O_3$ (sp. gr. 2·78). By passing the dusts through a sieve with 3,600 meshes per sq. cm. their adhesiveness may be increased by 15 per cent. as compared with the unsifted dust, the corresponding figures for 6,400 meshes being 30 per cent. With an increase in the dose of the fungicide from 0·05 to 0·3 per cent. the difference in the relative adhesiveness of the differently sized particle fractions of the dusts became much less marked. The adhesiveness of the dusts was found to vary with the different seeds on which they were used. The highest degree of adhesiveness in $NaAs_2O_3$ and Paris green (the most adhesive of the preparations tested) was secured by adjusting the velocity of the mixing apparatus (Ideal No. 1) to 30 to 60 rotations per minute; at a speed of 60 to 75 rotations per minute adhesiveness decreased considerably. The length of time required for mixing the dusts with the seed in such a way as to secure maximum adhesiveness ranged from 10 or 20 minutes for $NaAs_2O_3$ and Paris green to 30, 40, or even up to 70 minutes for the other, less adhesive preparations used in the tests. Strongly hygroscopic dusts, e.g., $NaAs_2O_3$, were found to increase in adhesiveness with an increased moisture content of the seed (oats).

The addition of field dust to the various preparations with a view to augmenting their adhesiveness was found to produce a directly opposite effect, especially in the cases of potassium bichromate and calcium arsenate. It is very important, therefore, that the seed should be freed as far as possible from dust and other soil particles before treatment. Generally speaking, the addition to the dusts of various neutral substances ('fillers'), e.g., chalk, talc, dextrin, and coal dust, caused a decline in adhesiveness. The adhesiveness of

the dusts tested (calcium arsenate, copper carbonate, and Paris green) to wheat seed-grain was found to increase in proportion to the extent of infection by bunt [*Tilletia caries* and *T. foetens*], reaching 88·78, 77·40, and 97·72 per cent., respectively, with 1 per cent. infection compared with 53·90, 66·17, and 75·20 with non-infected seed-grain.

Arnaud (G.) & Gaudineau (Mlle M.). **Le traitement de la carie du Blé.** [The treatment of Wheat bunt.]—*Comptes rendus Acad. d'Agric. de France*, xviii, 6, pp. 208–214, 1932.

The best results in the control of wheat bunt [*Tilletia caries* and *T. foetens*] in France were obtained during 1930–1 (a year with no unusual weather conditions) by the following treatments [cf. *R.A.M.*, x, p. 303]: 20 minutes' immersion in 0·25 per cent. formalin; one hour in 0·5 per cent. copper sulphate, followed by dusting with powdered lime; one hour in caseinated Bordeaux mixture, preceded by washing the seed-grain in water; and dusting with cupric chloride or copper oxychloride (slightly less effective than the foregoing) at 0·2 per cent. by weight of the grain treated. Generally speaking, the highest incidence of infection was found in the November and December sowings. Virtual immunity from bunt characterized the Red Hussar and Ridit varieties, while Blé de Pologne and Florence 135 showed a high degree of resistance. The most susceptible varieties were Ardito précoce, B2, Hybride 40, Carlotta Strampelli, Saisette du Maninet, and Bon Fermier.

Petit (A.). **Le traitement de la carie du Blé et la préservation des grains vis-à-vis des insectes parasites.**—[Wheat bunt treatment and seed preservation from parasitic insects].—*Ann. du Service Bot. de Tunisie*, vii, pp. 95–100, 1931.

Laboratory tests [which are briefly described and the results of which are tabulated] and inquiries among growers were made to ascertain whether wheat seed treated with cupric powders [against *Tilletia caries* and *T. foetens*] was preserved from insect attack when stored from one season to the next without treatment by carbon bisulphide. It was shown that this was so when the seed was treated with powdered pure mercury salts, e.g., calomel [mercurous chloride] at the rate of 250 gm. per quintal, and also with various salts of copper such as the carbonate when mixed with 5 to 20 per cent. of a mercury salt such as calomel or corrosive sublimate [mercuric chloride]. Pure copper salts under certain conditions protected the seed against insect attack for periods apparently exceeding six months. When cupric powders containing only a small amount of the metal were used, as a rule no protection resulted. Lead and copper arsenates and pyrethrum powder had no lasting effect.

Petit (A.). **Observations sur la carie du Blé.** [Observations on Wheat bunt.]—*Ann. du Service Bot. de Tunisie*, vii, pp. 101–103, 1931.

Experiments with a Tunisian strain of *Tilletia levis* [*T. foetens*], a southern European strain of *T. tritici* [*T. caries*], and three distinct strains of wheat bunt received from Dr. Jaczewski showed

that any variety of wheat highly resistant to any given strain of bunt is generally equally resistant to any other strain of either organism. Also, a wheat variety often shows the same degree of susceptibility to several different strains, and this susceptibility remains unchanged from one year to another. Various antiseptics had the same effect on all five strains; dusts with a basis of cupric chloride (10 to 15 per cent.) or cuprous chloride gave particularly good control. In tests with bunt the most important factor is the degree of susceptibility of the wheat, the virulence of the parasite varying little.

The fungicidal action of the so-called insoluble salts is explained (*a*) by chemical change, oxidation and the formation of soluble salts, and (*b*) by their becoming soluble owing to the presence of amines. The former process occurs with cuprous chloride and calomel [mercurous chloride], which produce, respectively, the highly soluble cupric chloride and soluble mercuric chloride, while the copper sulphides are rapidly changed into pentahydrated sulphate; the latter process takes place with copper phosphate, copper carbonate, copper arsenite, and lead arsenite.

Only copper arsenite is capable of sterilizing bunt spores in the soil so that they fail to contaminate the young wheat, though lead arsenite seems to approach it in this respect. The sterilizing action of the former is apparent even with a dose as minute as 250 gm. per hect.

PETIT (A.). **Observations sur le charbon du Blé (Ustilago tritici).** [Observations on loose smut of Wheat (*Ustilago tritici*).]—*Ann. du Service Bot. de Tunisie,* vii, pp. 105–109, 1931.

When healthy seed from a single ear of Mahon and Baroota wheat partially affected by loose smut (*Ustilago tritici*) was grown on exposed to natural infection, the disease was apparently absent in the former variety until the F_3 generation, while in the latter variety it reappeared in the F_4 generation. Similar results were obtained with bunt [*Tilletia caries* and *T. foetens*], when by selecting seed from resistant stools the F_2 generation showed 20 per cent. infected ears, as compared with 80 per cent. in the controls, but in the F_3 generation no difference could be detected between the two. It is concluded that in such cases no hereditary acquired immunity has been developed.

Under Tunisian conditions it was not found possible to substitute exposure to sunlight for the hot-water seed treatment against loose smut.

HANNA (W. F.) & POPP (W.). **Physiologic forms of loose smut of Wheat.**—Abs. in *Phytopath.*, xxii, 1, p. 11, 1932.

Two distinct forms of loose smut of wheat (*Ustilago tritici*) have been found in Manitoba [*R.A.M.*, ix, p. 190]. One, collected on Reward wheat, produces severe infection on many of the common wheats but failed to attack the durum varieties, Mindum and Pentad. The other, collected on Mindum, is pathogenic to the durums, while the common wheats tested showed moderate resistance to it.

Rathschlag (H.). **Vorkommen und Verbreitung der Fusskrankheitserreger in der Börde im Jahre 1930-31.** [Occurrence and distribution of the causal organisms of foot rot in the Börde during the year 1930–31.]—*Angew Bot.*, xiv, 1, pp. 28–33, 3 figs., 1 graph, 1932.

According to Schaffnit, *Ophiobolus graminis* is by far the most important agent of foot rot of cereals in Germany [*R.A.M.*, ix, p. 586]. During 1931 the writer conducted a series of experiments in Saxony to determine if this were true under local conditions.

In Petri dish cultures on oatmeal agar, *Fusarium culmorum* was isolated from the haulms of 76·4 per cent. of the samples of winter barley and *F. nivale* [*Calonectria graminicola*: ibid., xi, p. 228] from 15·5 per cent., the corresponding figures for winter and summer wheat being 56·3 and 15 per cent., respectively. As it was thought that the luxuriant mycelial growth of these fungi might have prevented the detection of *O. graminis* and *Leptosphaeria herpotrichoides*, the plants were replaced in the soil and re-examined some weeks later. *O. graminis*, however, was only found on 7 out of 106 haulms, while *L. herpotrichoides* was absent.

At the time of maturation of the plants, the macroscopic symptoms generally give a clue to the identity of the attacking fungus. Infection by species of *Fusarium* is characterized by a brown discoloration of the stem base, and the roots are fairly resistant to pulling, whereas in invasion by *O. graminis* the haulm bases are deep black and the plants are readily extracted from the soil. In the Börde, however, the economic importance of *O. graminis* is slight owing to its scarcity.

Observations on cereals in the field in the spring and autumn indicated that young plants are only liable to attack by the foot-rotting fungi when grown under unfavourable conditions. As a rule, conspicuous symptoms do not appear until the plants are approaching maturity.

Bockmann (H.). **Ein Beitrag zur Biologie und wirtschaftlichen Bedeutung des Erregers der Braunfleckigkeit des Weizens: Macrophoma hennebergii (Kühn).** [A contribution to the biology and economic importance of the causal organism of brown spotting of wheat: *Macrophoma hennebergii* (Kühn).]—*Angew. Bot.*, xiv, 1, pp. 79–86, 1932.

During the long spell of wet weather in July, 1931, the Schleswig-Holstein wheat crops were severely attacked by *Septoria nodorum* (*Macrophoma hennebergii*) [*R.A.M.*, vi, pp. 146, 464], which causes a dark chocolate-brown spotting of all the aerial parts of the plant, especially the glumes. About three weeks after infection the minute dark pycnidia appear on the spots. The spores are surrounded by a thin mucilaginous sheath which serves to attach them to the substratum.

Laboratory tests in 1930 and field experiments in 1931 indicated that the pycnospores of *S. nodorum* are not disseminated by wind, which appears to hinder rather than promote infection, by drying the plants and so depriving the spores of the moisture essential for their germination. The present researches have shown conclusively that epidemic outbreaks of brown spotting are confined to damp

seasons, when the causal organism attacks both healthy and constitutionally enfeebled plants, such as those damaged by lodging. A serious reduction of yield is only to be anticipated in the latter case. The disease may best be combated by the avoidance of the various factors tending to disturb the normal development and equilibrium of the plants, e.g., the unbalanced use of nitrogen.

Christensen (J. J.) & Graham (T. W.). **Physiologic specialization in Helminthosporium gramineum.**—Abs. in *Phytopath.*, xxii, 1, p. 6, 1932.

Eighty-four out of 226 monospore cultures of the barley stripe organism, *Helminthosporium gramineum*, isolated from 76 different collections, were culturally distinct [*R.A.M.*, x, p. 232]. Forty-nine of these were obtained from Minnesota and the rest from various parts of the United States, Canada, and Germany. With two possible exceptions, a distinct cultural race was secured from each collection. Occasionally two different races were isolated from a portion of a diseased leaf. The percentage of infection produced by 75 different races on several barley varieties ranged from 0 to 90. Generally speaking, the varieties ordinarily susceptible in the field were heavily attacked by a large number of races in artificial inoculation experiments, but some of these varieties proved susceptible to certain races and not to others.

Reed (G. M.). **Inheritance of resistance to loose and covered smut in a hybrid of Early Gothland and Victor Oats.**—*Amer. Journ. of Botany*, xix, 2, pp. 194–204, 1932.

The writer here expands and tabulates the results of his studies from 1927 to 1931 on the inheritance of resistance to the loose and covered smuts of oats (*Ustilago avenae* and *U. levis* [*U. kolleri*]) in oat hybrids between the Early Gothland and Victor varieties [*R.A.M.*, viii, p. 487; ix, p. 520]. With loose smut, both the F_2 and F_3 generations showed practically complete susceptibility, while with covered smut there was a marked preponderance of resistant plants in the F_1, F_2, and F_3 generations. In regard to the latter smut, resistance is clearly dominant and segregation occurs in the second generation.

Barger (G.). **Ergot and ergotism. A monograph based on the Dohme lectures delivered in Johns Hopkins University, Baltimore.**—xvi + 279 pp., 6 pl., 23 figs., 1 graph, 2 maps, London and Edinburgh, Gurney & Jackson 1931.

This interesting monograph on ergot (*Claviceps purpurea*) and ergotism comprises sections on the following aspects of the subject. Chapter I is devoted to the history of ergot from the earliest times, including notes on the distribution of rye, the various names applied to ergot in different languages, and its introduction into medicine. Chapter II deals with epidemics of gangrenous and convulsive ergotism in various countries, citing numerous references to the disease from ancient writers and those of the Middle Ages and modern times. In Chapter III the botanical side of the subject is considered under the headings of history, characters of the sclerotium, life-cycle, ergot in relation to agriculture, species of

Claviceps, hosts of *Claviceps* [a list of which is given], and biological races. Chapter IV deals with the chemical constituents of ergot in two groups, viz., those peculiar to ergot, namely, ergotinine and ergotoxine, ergotamine and ergotaminine [cf. *R.A.M.*, xi, p. 103], and those not peculiar to ergot. Chapter V discusses the pharmacological and clinical, and Chapter VI the pharmaceutical and forensic aspects of ergotism.

A bibliography of over 40 pages is appended.

Ivanoff (S. S.). **Stewart's disease of Corn.**—Abs. in *Phytopath.*, xxii, 1, pp. 13–14, 1932.

The causal organism of Stewart's disease of maize (*Aplanobacter stewarti*) [*R.A.M.*, x, p. 238] has been found to enter the roots of plants grown in artificially infested soil through wounds inflicted artificially or by the agency of grubs. Histological and isolation studies showed that in the leaf tissue the bacteria escaped from the vessels and entered the parenchyma, causing discoloration, plasmolysis, and death of the cells. In the kernel the bacteria were observed in the vessels and in the adjoining cavities of the chalazal region, between the testa and the aleurone layer, and between the endosperm cells. In the tassel *A. stewarti* was detected in the vessels of rachids, rachillas, glumes, and filaments. The bacteria were isolated from the exudate on leaves and the water at the base of the unfolding leaves, from the glumes, anthers, and pollen of diseased plants, and from maize stubble overwintered in the field. A selective medium was developed with which the organism was isolated from the soil.

Stanley (A. R.) & Orton (C. R.). **Bacterial stalk rot of sweet Corn.**—Abs. in *Phytopath.*, xxii, 1, p. 26, 1932.

The bacterial stalk rot of maize caused by *Bacterium dissolvens* [*R.A.M.*, viii, p. 28] appeared in epiphytotic form in the Ohio Valley in West Virginia, during 1930 and 1931, the Golden Bantam and a number of other varieties [which are listed] being attacked. Needle-prick inoculations on young maize stalks result in the rapid invasion of the parenchyma, a watery brown discoloration and softening of the tissues, and crumpling of the stalks. The numerous strains that were isolated are motile in broth cultures and produce H_2S on lead acetate agar but no indol in tryptophane broth. A striking similarity with *Bacillus carotovorus* was found.

Moore (M. B.). **The genetics of Ustilago zeae.**—Abs. in *Phytopath.*, xxii, 1, p. 20, 1932.

A study was made of the gametic (F_1) segregates from crosses between one monosporidial line of *Ustilago zeae* [*R.A.M.*, xi, p. 363] and each of two others with contrasting cultural characters. All the F_1 lines isolated from the two crosses fell into 17 cultural groups, 49 from one cross falling into 12 and 38 from the other into 13 groups. A few F_1 lines were almost identical with one or another of the parental lines. All the characters studied, including sex, were apparently governed by multiple factors. The segregation of factors for cultural characters occurred in the second division of the fusion nucleus or began in the first and was completed

in the second; occasionally this process may have taken place in still later divisions. Three different combinations of the F_1 lines from a single smut spore varied greatly in their capacity to form spores on maize plants, though all produced abundant galls consisting of mycelium and hypertrophied host cells. The number of spores formed varied with the maize variety inoculated. One combination which produced numerous large galls formed only a few spores in occasional galls.

Davis (G. N.). **Relation of axillary-bud development to nodal smut infection in the Corn plant.**—Abs. in *Phytopath.*, xxii, 1, pp. 7–8, 1932.

Eight hundred maize plants were used to determine the relationship between axillary bud development and the appearance of nodal smut [*Ustilago zeae*] boils [*R.A.M.*, ix, p. 237], 400 being inoculated on 13th June and smut readings taken on 21st August. On 22nd August, 100 of these plants were injured by removing the ears, another 100 by removing the tops, and 100 by removing both, while 100 were left uninjured as controls. Four hundred uninoculated plants were similarly treated. Final smut readings were taken on 16th September. In the inoculated plants nodal infection in the uninjured controls increased by 20·5 per cent. between 21st August and 16th September, while the removal of tops and ears resulted in increases of infection of 29 and 63 per cent., respectively, over the controls, the corresponding figures for the removal of both tops and ears being 52·2. In the uninoculated series nodal infection in the uninjured controls increased by 33·3 per cent. in the same period, removal of tops resulted in 43·7 per cent. increase, removal of ears 56·2 per cent., and removal of both 36·8 per cent. Seven out of 10 axillary buds from sweet maize were found to contain smut mycelium ten days after inoculation, while 110 days after inoculation 66 per cent. of the apparently healthy buds from ten of the plants showed small mature smut boils when held before a strong light.

Hoppe (P. E.), Holbert (J. R.), & Dickson (J. G.). **The relation of maturity of seed to seedling-blight susceptibility in Dent Corn.**—Abs. in *Phytopath.*, xxii, 1, p. 12, 1932.

Investigations in Wisconsin have shown that the environment during the growth and maturation of the mother plants of Dent maize greatly affects the disease reaction of seedlings of the subsequent crop when inoculated with *Gibberella saubinetii* [*R.A.M.*, x, p. 724], apart from the genetic potentiality for resistance in the strains. Experimental data on the seed from several hundred self-pollinations in inbred lines further indicated that resistance to seedling blight increased with the maturity of the parent seed. The rates of increase in resistance, however, varied at the different stages of maturation of the parent seed.

McNew (G. L.). **Parasitism of Diplodia zeae on the crown of the Corn plant.**—Abs. in *Phytopath.*, xxii, 1, p. 18, 1932.

On land previously sown with maize, plants from nearly disease-free seed showed 12 per cent. collar infection with *Diplodia zeae*,

which was present to the extent of 18 per cent. in those from treated infected seed [*R.A.M.*, x, p. 785]. All the plants grown in steamed soil to which cultures of *D. zeae* were added contracted infection, which was reduced and delayed when the soil was infested later in the growing season. At maturity 80 per cent. of the plants showing heavy infection of the crown were invaded to the second internode. Under similar conditions but omitting the inoculum, the same symptoms developed on plants from seed naturally infected by *D. zeae*. A series of plants with 81 per cent. mesocotyl infection but no seedling blight showed 80 per cent. collar infection at maturity. The fungus enters the collar either from the soil or from the infected seed. Root reduction due to collar infection was experimentally shown to be greatest in compost soil at 45 per cent. of the water-holding capacity.

Reddy (C. S.). **Basisporium dry rot of Corn.**—Abs. in *Phytopath.*, xxii, 1, pp. 22–23, 1932.

Injury by *Basisporium gallarum* [*Nigrospora sphaerica*: *R.A.M.*, xi, p. 297] is associated with cessation of translocation and occurs at the time of germination, after normal maturity, and in cases of premature death from cold or other causes. Infected seed dies within a few days after planting in soils slightly below the temperature range for germination, the germ being killed by the fungus before active translocation begins. Seed treatments are most beneficial under conditions of greatest injury by *N. sphaerica*, e.g., where the soil is cold at the time of germination. Seed-maize strains germinating readily below 11° C. are little affected by *N. sphaerica*. Artificial inoculation tests showed that natural inoculum was widespread at the time of earing, the number of infected ears not being appreciably increased by artificial wound inoculations. With or without the latter, susceptible ears became infected while resistant ones did not. Resistance in the ears was found to be correlated with a high hydrogen-ion concentration in the cobs—an inherited character that may well be utilized in breeding for resistance to this type of ear rot.

Melchers (L. E.), Ficke (C. H.), & Johnston (C. O.). **A study of the physiologic forms of kernel smut (Sphacelotheca sorghi) of Sorghum.**—*Journ. Agric. Res.*, xliv, 1, pp. 1–11, 2 figs., 1932.

This report embodies the results [presented in tabular form] of the authors' studies from 1927 to 1929, inclusive, at the Kansas Agricultural Experiment Station, of the specialization of covered kernel smut of sorghum (*Sphacelotheca sorghi*) [*R.A.M.*, xi, p. 235]. The tests, which comprised 80 [named] varieties, selections, and hybrids covering the various groups of sorghums, showed the [illegible] physiologic forms previously recorded [illegible] form 4 which [illegible] and form [illegible] differential hosts [illegible] varieties, selections, and hybrids which formerly were considered to be highly resistant to or immune from the smut, are really somewhat

susceptible to one or more of the physiological forms, a fact which has considerably complicated the problem of breeding for resistance to the disease.

Comparative morphological studies in 1929 showed that the sori of the five forms exhibit some rather definite differences in their length, colour, and manner of rupturing. While these differences may be helpful in making tentative identifications, it is still doubtful whether the forms can be separated solely on this basis. There was evidence that form 1 is most common and widely distributed in the United States; form 2 is of rarer occurrence, and definite information is still lacking as to the distribution of forms 3, 4, and 5. Experiments during several years have established that all the five forms of *S. sorghi* are effectively controlled by dusting the seed-grain with copper carbonate, a method which is almost exclusively used in Kansas.

Cocchi (F.). **Un marciume dei Limoni dovuto a Pleospora herbarum (Pers.) Rabenh.** [A rot of Lemons due to *Pleospora herbarum* (Pers.) Rabenh.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 3, pp. 179–213, 1 col. pl., 12 figs., 1931.

From a Sicilian lemon the author in January, 1931, isolated the conidial stage (*Macrosporium commune*) of *Pleospora herbarum*, which he states has not previously been recorded on citrus fruits, his organism differing from that recorded in Fawcett and Lee's book [*R.A.M.*, v, p. 735] in the readiness with which it formed conidia on various media, and being also quite distinct from *P. hesperidearum* Catt. [ibid., ix, p. 106]. The lesions caused [which are depicted in colours] were superficially almost indistinguishable from those produced by *Alternaria citri*, and when further isolations were made from lemons showing apparently similar lesions an *Alternaria* was constantly present in the cultures.

Owing to insufficient naturally infected material, the progress of the disease was studied on artificially inoculated lemon fruits. Eight or ten days after a fragment of mycelium from pure culture had been inserted through a wound in the skin, the surface round the wound became wrinkled and dark; if the temperature was sufficiently high the spot grew larger and darker daily, and on attaining a diameter of 2 or 3 cm. it consisted of a dark brown centre surrounded by a lighter halo. The centre then turned black and often became covered with a greyish, later dark green mould. The attack was most rapid when the inoculation was made near the apex of the fruit, otherwise the appearance of external symptoms was much retarded, though the fungus continued to spread in the tissues. In the inoculations near the middle of the fruit symptoms were first visible after about six weeks but then developed rapidly so that some five days later the distal half of the fruit turned brown and the surface of the lesion around the point of inoculation, which was slightly wrinkled, showed the characteristic greyish-green mould. The diseased area remained firm and did not become soft.

Perithecia were not found on fruits inoculated a few months previously, but developed on carrot in a little more than a month. The morphological characters [which are described] establish clearly

their identity with those of *P. herbarum* and remained fairly constant on numerous media. On carrot and potato a slight rose pigmentation was formed, but disappeared as the colony darkened; on potato glucose agar the rosy colour was more intense and remained permanently. The P_H value of the medium did not affect the production of this coloration. Growth was best on acid media.

For infection to take place lesions in the skin appear to be necessary. The conidia showed great resistance to various fungicides. The only satisfactory method of control appears to lie in improved cultural practices.

Black spot of Citrus.—*Fruit World of Australasia*, xxxiii, 2, p. 76, 1932.

While there is no outward sign of black spot [*Phoma citricarpa*: *R.A.M.*, x, pp. 161, 223] on oranges in New South Wales before September or October of the year following infection, it has been ascertained that the fruits become infected at and after blossoming. Experimental evidence was obtained that almost complete control (a reduction in the percentage of spotted fruits from nearly 100 to 5) follows two applications of Bordeaux mixture 6-4-80 plus half a gallon of red spraying oil per 80 galls. (applied under a pressure of about 250 to 300 lb.) made when about half the blossom has fallen and again six to eight weeks after blossoming. Every effort should be made to keep the young, developing fruit well covered with spray and in some seasons three applications should be given, the first as above, the second five weeks later, and the third five weeks after the second.

Reports received from Experiment Stations, 1930–1931.—242 pp., 2 diags., 51 graphs, 1 plan, London, Empire Cotton Growing Corporation, 1932.

This compilation of the reports for the season 1930–1 received from various cotton-growing stations of the British Empire [cf. *R.A.M.*, x, p. 594] contains, among others, the following items of phytopathological interest.

Arrangements were made for all the more important new strains growing at the experimental farm at Shambat (Sudan) to be tested at the research farm at Wad Medani in the Gezira for resistance to leaf curl [ibid., xi, pp. 176, 238 and next abstract] and blackarm disease [*Bacterium malvacearum*]. Three fixed Sakel Sea Island hybrids are being propagated, two of which XH 1029 and XH 1229, are highly resistant to leaf curl and are considered to be possible alternatives to the susceptible Sakel cotton at present grown in that area. Shambur Sakel IV, which was recently tested on a large scale for the first time, is being propagated in view of its resistance to leaf curl and the excellent yield results obtained in the Shambat variety test. The 'Egyptian line test' at Shambat included several new types from Egypt as well as many new strains; nine of the varieties tried gave indications of being higher yielders than Sakel and several were highly resistant to leaf curl.

In 1930, blackarm was bad in the earliest stages in some parts of

the farm at Shambat and a propagation area of Sakel 186 was almost killed out; all the plants which were not actually killed by the disease rapidly recovered, however, when the rains ceased, and the final effect on the general crop must have been very slight. Leaf curl appeared towards the end of September at roughly the same date as in the Gezira area. The disease undoubtedly somewhat reduced the final yield at Shambat, but apparently unaffected plants also gave poor final yields, and the author is of the opinion that factors other than blackarm and leaf curl are of primary importance at Shambat. All the observations made showed that the poor yield obtained was due in the first place to some factor adversely affecting flower production in October and November.

In the cotton breeding plot at Bukalasa, Uganda, owing to the importance of blackarm as a limiting factor in yield in certain years [ibid., xi, p. 353], very close attention was paid during the period under review to the spread of the disease and the resistance offered to it; weekly counts of leaf spot infection were made as long as the size of the plants allowed this to be done accurately. Infection varied greatly in intensity with the varieties planted, and definite degrees of resistance were observed. Thus, three families of S.G. 99 (Allen var.) gave 100 per cent. infection in the first two weeks, while B. 31 remained completely resistant throughout the season. The angular leaf spot form of the disease appeared in August about three weeks after planting and spread rapidly until about 80 per cent. of the crop was affected. The blackarm form, however, was negligible. To ascertain the effect of the change of seed in the Teso and Lango districts [loc. cit.], Local N. 17 and Busoga N. 17 were included in three trials in Teso and one in Lango. The germination was in favour of the Busoga seed at all centres, this seed being about 8 per cent. better in this respect than Local seed. There appeared to be no difference between the two as regards angular leaf spot infection. The final yields showed no significant differences whatever.

Vageler (P.) & Alten (F.). **Böden des Nil und Gash V.** [Soils of the Nile and Gash V.]—*Zeitschr. für Pflanzenernährung, Düngung und Bodenkunde*, xxiii, 3–4, pp. 149–207, 14 figs., 6 diags., 2 graphs, 2 maps, 1932.

In connexion with an exhaustive survey of the physical and chemical properties of the Nile and Gash soils the writers state that the sensational fall in the cotton yields of the Gezira during the past year is primarily attributable to two diseases, viz., blackarm (*Pseudomonas* [*Bacterium*] *malvacearum*) and leaf curl [see preceding and next abstracts], both of which assumed epidemic form. In its turn susceptibility to these diseases is enhanced by the incapacity of the crop to react to applications of organic and synthetic fertilizers by reason of the high salt content of the soil in the superficial layers.

Massey (R. E.) & Andrews (F. W.). **The leaf curl disease of Cotton in the Sudan.**—*Empire Cotton Growing Review*, ix, 1, pp. 32–45, 6 pl., 2 graphs, 1 diag., 1932.

This is a brief account of the authors' field and experimental

investigation of the leaf curl disease of cotton in the Sudan, the results of which are in general agreement with those obtained by Kirkpatrick [*R.A.M.*, xi, p. 328 and preceding abstracts]. The trouble is stated to be most widely spread in the Gezira Sakel cotton area; it also occurs, however, in many other localities, and at Shambat, in particular, is present to a very variable degree on all the cultivated types of cotton, with the exception of the Asiatic ones. The great majority of plants show the first symptoms (which usually appear towards the end of September in cotton sown about the middle of August) on the second and third leaves below the main growing point, the infection then spreading with greatly varying intensity. The secondary growth from the node below the infected leaf usually exhibits symptoms of increased severity, and this is particularly true of the secondary growth induced by cutting back a diseased plant; the latter fact is believed to indicate that the infective principle is able to travel equally well down and up the stem. It was shown by numerous experiments that it is difficult to infect cotton plants that are not in active growth, a feature which is characteristic of virus diseases.

Histologically, the principal effect of infection during active growth is the stimulation of normal non-meristematic tissue to meristematic activity, leading to considerable hypertrophy of the cells of the leaves, bracts, and stems, and resulting in various malformations. In the stem irregular bundles develop, mainly confined to the ribbed portion of the cortex, although there are definite signs of a meristematic activity in the whole of the cortical layer; these bundles consist of central xylem elements surrounded by a cambium and phloem. New vascular bundles may also be formed in the medulla of infected petioles. In diseased leaves the normal palisade tissue is replaced by rectangular cells with large intercellular spaces which develop on both sides of the leaf, and similar cells also develop below the larger bundles, on the under surface of the leaf. No abnormal intracellular bodies were observed in the diseased tissues.

All attempts to transmit the disease by means of the expressed juice from infected plants gave negative results. The juice expressed from diseased leaves differs strikingly from that obtained from normal leaves in that it remains green while the latter immediately changes to a reddish-plum colour, owing to some chemical reaction which is apparently suppressed in the diseased leaves; all gradations of colour from red to green may, however, occur in the diseased juice, according to the severity of infection. The diseased leaves apparently contain much more chlorophyll than normal, and a chemical analysis of the expressed juices showed that the leaf curl sample contained a higher percentage of nitrogen, calculated on the dry weight basis.

No clear evidence was obtained that the disease can be transmitted by seed, though one suspicious case was observed. In a series of plot experiments to determine the effect of manuring on the incidence of leaf curl, no appreciable influence of the different manures was observable. The analysis of healthy and diseased leaves showed no differences in residual starch, pentosans, or

nitrogen but the determination of diastatic activity gave much higher figures for the diseased than the healthy leaves.

WARE (J. O.), YOUNG (V. H.), & JANSSEN (G.). **Cotton wilt studies. III. The behaviour of certain Cotton varieties grown on soil artificially infested with the Cotton wilt organism.**—*Arkansas Agric. Exper. Stat. Bull.* 269, 51 pp., 2 figs., 1932.

Continuing their investigations on cotton wilt (*Fusarium vasinfectum*) in Arkansas [*R.A.M.*, viii, p. 718; xi, p. 160], the writers found from seasonal counts [the results of which are tabulated] that, in general, the damage to susceptible varieties, e.g., Trice and Delfos, begins sufficiently early in the season to affect the yield considerably. In several cases a correlation was observed between susceptibility to wilt and earliness, but this was not a consistent feature, and on the other hand, lateness did not necessarily connote a high degree of resistance. Several of the 15 best cotton varieties may be recommended to Arkansas farmers for wilt-infested lands, e.g., Arkansas 17, D. & P.L. 6, or Lightning Express on bottom or delta lands for staple cotton; Super Seven, Miller, or Arkansas Rowden 40 on the same lands for staple of medium length; and Dixie Triumph and Dixie 14 for short staple either on bottom lands or wilt-infested upland. Among the 'tolerant' varietes, i.e., those giving satisfactory yields on wilt soil unless the infestation is intense, may be mentioned Cleveland 54, Arkansas Rowden 2088 and 2119, D. & P.L. 4, Express 121, and Wilson Type Big Boll.

Annual Report of the Indian Central Cotton Committee, Bombay, for the year ending 31st August, 1931.—119 pp., 1932.

The following items of phytopathological interest occur in this report. The Bombay Agricultural Department is distributing from Dharwar the seed of a cross between two previous cotton selections—one a high yielder but susceptible to wilt [*Fusarium vasinfectum*: *R.A.M.*, x, p. 379] and the other less prolific but resistant. This cross is wilt-resistant and has the desirable characters of Dharwar (the susceptible parent). The prolific, wilt-resistant strain of *Gossypium verum* (No. 262) is in very great demand in the Central Provinces and Berar, where arrangements for the supply of the seed to growers have been organized on a large scale. During the year two new high yielding, wilt-resistant strains of 262 were isolated, viz., an early one to take the place of 'Jadi' in the northern and plateau districts, and a late strain suitable for the eastern portion of the cotton-growing tract.

In the sandy alluvial soils of Gujerat, root rot is the principal disease of cotton, and a scheme has been sanctioned for two years for an investigation of this problem.

WOODROOF (NAOMI C.). **Treating Cotton seed by the dusting method.**—*Georgia Exper. Stat. Bull.* 170, 16 pp., 1 fig., 1931.

This bulletin contains the experimental data on the continued experiments to determine the value of a number of chemical dusts in the control of cotton root rot (*Fusarium moniliforme*) [*Gibberella moniliformis*] in Georgia [see above, p. 430]. In the root rot

experiments, the average per cent. increase in germination from the highest yielding dust treatment for each year from 1926 to 1931 was 8·28 over the untreated control and 10·13 over the acid-delinted seed, the corresponding increases in yield being 140 and 187·1 lb. seed cotton, respectively.

All the dust treatments reduced the number of seedlings showing cotyledonary infection by *Bact. malvacearum* much below the figure for the untreated controls. In 1927 there were 11·6, in 1928 39·6, in 1929 7·8, and in 1931 47 times as many plants with angular leaf spot among the controls as in any single treatment. In 1927 5 out of 14, in 1928 3 out of 5, in 1929 2 out of 5, and in 1931 5 out of 7 treatments controlled angular leaf spot. In no case were lesions found on the cotyledons of seedlings from delinted seed soaked in mercuric chloride. Mercuric resinate gave perfect control in two out of three trials.

The benefits of seed treatment are greater in seasons when cold, wet weather follows planting, mainly on account of the protection afforded by the dust to the seed and seedlings. Ceresan is recommended for the treatment of cotton seed, this product being more readily accessible than the Du Bay preparations which seem, however, to be equally effective. The cost of ceresan is about 50 cents per lb., this quantity being sufficient to treat four bushels, using the dust at the rate of 4 oz. to 30 lb. of cotton seed. The acid-delinting process is considerably more expensive. A home-made duster is briefly described and directions are given for the application of the treatment.

FAHMY (T.). **The sore-shin disease and its control.**—*Min. of Agric., Egypt, Tech. & Sci. Service (Plant Protect. Sect.) Bull.* 108, 24 pp., 7 pl., 1931.

This is a progress report of the study since 1923 of the sore shin disease of cotton in Egypt and of its causal organism (*Rhizoctonia* sp.) [*R.A.M.*, x, p. 379], which was identified by Briton-Jones as *Corticium vagum* [*C. solani*: ibid., v, p. 19; regarded by Forsteneichner as a distinct species, *R. gossypii*: ibid., x, p. 788]. The disease is stated to be present wherever cotton is grown in Egypt, and to be especially severe on heavy, moist soils; all varieties of cotton are susceptible to it if sown early in the spring, when temperatures are unfavourable for the rapid development of the seedlings. Examination of young plants grown in artificially infected soil showed that the fungus attacks the seedling at the hypocotyl; after penetrating the cortical layers it forms a compact hyphal growth which kills the underlying cells; the latter are then progressively entered by the parasite until all the tissues at the hypocotyl are invaded and destroyed, the size and depth of the resulting cavity largely depending on the environmental conditions. When moisture and temperature are such as to retard the growth of the host, the fungus continues its progress until the seedling is girdled and killed; if, on the other hand, temperature rises during the invasion stage, the plant appears to be able to react by the production of suberin layers around the infected region even after the formation of a cavity, and such plants reach maturity, although large scars may be

present to show the point of attack at the seedling stage. In adult recovered plants there is a thick deposit of a resin-like substance on the walls of the cavity, which apparently cannot be penetrated by the hyphae of the fungus. It is pointed out that the rot which results from an attack of sore shin is not due solely to the *Rhizoctonia*, secondary organisms playing a considerable part in the rapid destruction of the invaded host tissues.

Of the many external conditions which have an influence on the incidence and severity of sore shin, field observations have shown that temperature and particularly rainfall in the spring are the most important, since rain, besides lowering the temperature of the soil, also hardens the surface and thus delays the emergence of the seedlings. Other important factors are the texture and tilth of the soil, and the depth and method of sowing. The best control of the disease was obtained by planting cotton seed previously soaked in water for 48 hours, in damp but not moist soil which had been brought to a fine tilth. Experiments with various seed treatments showed that they are economically valueless if the temperature continues below normal during the greater part of the early growth of the cotton plant.

WILLE (J.). **Die Bekämpfung der 'Chupadera'-Krankheit der Baumwolle in Perú durch Beizung mit Ceresan.** [The control of the 'chupadera' disease of Cotton in Peru by disinfection with ceresan.]—*Nachricht. über Schädlingsbekämpf.*, vii, 1, pp. 15–18, 2 figs., 1932.

Very good control of the 'chupadera' (sore shin) disease of cotton (*Rhizoctonia*) [*Corticium solani*] was obtained over an area of 6 hect. near Callao, Peru, by dusting the seed with ceresan at the rate of 600 gm. per 70 kg. of seed [cf. *R.A.M.*, x, p. 103]. The incidence of infection was reduced from 80 to 30 per cent. This disease is stated to cause heavy infection not only of the very young seedlings but also of more fully established ones, on which it causes a kind of root scorch. It is most severe when the seed is sown relatively early in the season. In the author's experiment, which was carried out under strictly controlled conditions, the untreated drills required extensive replacement of the killed plants, whereas in the treated rows the gaps were too few to have an appreciable effect on the final stand.

PETCH (T.). **Some Philippine entomogenous fungi.**—*Ann. Mycol.*, xxx, 1–2, pp. 118–121, 1932.

A list is given of eleven entomogenous fungi from the Philippine Islands, most of which are parasitic on Aleyrodidae. *Hypocrella philippinensis* on a Aleyrodid on undetermined leaves and *Aschersonia philippinensis* (its conidial stage) are described as new, with Latin diagnoses.

BOCZKOWSKA (MARJA). **Zmiany w organizmie gąsienicy bielinka kapustnika (Pieris brassicae L.) wskutek porażenia owadomorkiem korzonkowym (Entomophthora sphaerosperma Fres.).** [Changes in the body of the larvae of the Cabbage butterfly (*Pieris brassicae* L.) caused by infection with an entomogenous

fungus (*Entomophthora sphaerosperma* Fres.).]—Reprinted from *Roczniki Nauk Rolniczych i Leśnych* [*Yearbooks of Agric. and Silvicult. Sciences*], Poznań, xxvii, 20 pp., 1 pl., 8 figs., 1932. [English summary.]

The author states that her examination of the larvae of the cabbage butterfly (*Pieris brassicae*) exhibiting various stages of the disease caused in them by *Entomophthora sphaerosperma* [*R.A.M.*, viii, p. 502] showed that in the initial stage, characterized by a gradual disappearance of green colour from the body of the larva, mycelial elements of the fungus are carried in the blood stream. Hyphal bodies [ibid., viii, p. 719] are not formed. The organism chiefly attacks and destroys the oenocytes, while the adipose tissue is attacked to a certain degree at the beginning of the infection, but is never a centre of vigorous development of the fungus. The internal cavities, the muscles, Malpighian tubes, and the epidermal tissue are only invaded after death. Phagocytosis of the mycelium in the body of the larva was not observed. Cultural experiments indicated that the best media for growth of the fungus are the blood and the oenocytes, and that the organism does not develop on the plant remains inside the intestine; it also refused to grow on artificial media containing peptone, carbohydrates, and mineral salts. Azygospores are formed in the host tissues from the first stages of infection.

Wallengren (H.). **Metarrhizium anisopliae sasom medel i kampen mot Pyrausta nubilalis Hb.** [*Metarrhizium anisopliae* as a means for the control of *Pyrausta nubilalis* Hb.]—*Lunds Univ. Arsskr.*, N.F., Avd. 2, xxvii, 12, 15 pp., 1 fig., 1 diag., 1931. [German summary.]

Continuing his laboratory and greenhouse experiments at Lund, Sweden, on the control of the European corn borer (*Pyrausta nubilalis*) by *Metarrhizium anisopliae* [*R.A.M.*, ix, p. 716], the writer found that the newly emerging larvae of the insect are highly susceptible to infection by the conidia of the fungus, the mortality in three tests being 70·15, 54·5, and 45 per cent. during the first 20 days of life. In the later stages (34 to 65 days old) only 6·66 per cent. of the larvae were killed in 15 days. The conidia of *M. anisopliae* are unable to infect the eggs of the corn borer.

Numerous experiments were conducted to determine whether maize plants could be protected from infestation by *P. nubilalis* by dusting them with the conidia of *M. anisopliae*, either in the pure state or mixed with potato flour (10:2 or 10:1). Excellent results were obtained by both methods, the incidence of mortality of the larvae being 99·13 per cent. in the former and 99 in the latter. Field experiments by Dr. B. Hergula at Zagreb, Jugo-Slavia, with conidia of *M. anisopliae* supplied by the writer, confirmed the Swedish laboratory results and indicated the feasibility of practical control by this method.

Talice (R. V.). **Parasitisme des hérissons par les Mycotorulées.** [Infection of hedgehogs by species of Mycotorulaceae.]—*Ann. de Parasitol. Humaine et Comp.*, x, 1, pp. 81–84, 1932.

In this note the author states that the post-mortem examination

of six out of eight apparently healthy hedgehogs which were killed by him, revealed the presence on the mucous membranes and in some of the glandular cavities of their digestive tract, and also in their faeces, of two fungi which subsequent cultural studies showed to be referable to the Mycotorulaceae [see below, p. 476]. One of these organisms was identified as *Mycotorula albicans* (Ch. Robin 1853), and the other as a species of *Mycotoruloides*. It is pointed out that no visible lesions were caused by either of these organisms in the digestive tract of the hedgehogs.

Steyn (D. G.). **Investigations into the cause and transmission of lumpy wool affecting merino sheep and its treatment.**—*Seventeenth Rept. Dir. Vet. Serv. & Animal Indus., Union of South Africa*, Part i, pp. 205–213, 6 figs., 1931. [Abs. in *Veterinary Bull.*, ii, 2, p. 75, 1932.]

Investigations by the author showed that 'lumpy wool' of sheep in South Africa, first reported to the authorities in 1925, is essentially the same as the condition caused in Australia by *Actinomyces dermatonomus* [*R.A.M.*, x, p. 455]. In South Africa, lumpy wool prevails chiefly in wet, misty districts, such as Natal and the Eastern Cape Province, and is commonest in warm, moist weather. Mortality is low and transmission slow, but when climatic conditions favour the fungus the diseased sheep, unless treated, die.

Transitory lesions closely resembling those characteristic of the disease were produced by rubbing wool scrapings showing the fungus into moistened skin, intact or scarified; similar results followed when pure cultures of the fungus were poured on to scarified skin.

The early stages of the disease readily respond to applications of a mixture of raw linseed oil and 3·5 per cent. tincture of iodine in equal parts, but sheep showing an advanced stage of the disease should be slaughtered and those affected should be isolated.

Bergmann (M.). **Skin diseases as the cause of leather defects.**—*Collegium, 1931*, pp. 823–830, 1931. (German.) [Abs. in *Journ. Soc. Chem. Ind.*, li, 18, p. 360, 1932].

Certain defects in leather, e.g., 'Salzstippen' ['salt spots'] and damage of the papillary layer, have been traced to the action of fungi on the raw skin. *Trichophyton* spores have been found in damaged parts of the grain of finished leather, in the tissues of leathers tanned from diseased Bavarian hides, and in the hair canals in finished leathers. The proteinases in the fungi can attack skin collagen, forming therewith a compound possessing different colloid-chemical properties from those of the collagen itself.

Sartory (A.), Sartory (R.), Sternon (F.), & Meyer (J.). **Une dermatomycose causée par une levure nouvelle du genre Saccharomyces : 'Saccharomyces sternoni' n. sp.** [A dermatomycosis caused by a new yeast of the genus *Saccharomyces*: *Saccharomyces sternoni* n. sp.]—*Bull. Acad. Méd.*, cvii, 4, pp. 120–121, 1932.

From the squamae covering a deep-seated, inflamed lesion in the interdigital region of the right foot of a joiner, the writers isolated a yeast characterized by spherical cells, 2 to 2·5 μ in diameter, and

by globular, spherical, or slightly oval asci, 3·75 to 4 μ in diameter, always containing four round ascospores, 1·25 to 1·5 μ in diameter. The optimum temperature for the growth of the fungus was found to be between 23° and 25° C. Inoculation experiments on guinea-pigs resulted in the development of erythemato-squamous lesions closely resembling those on the above-mentioned patient. The name *Saccharomyces sternoni* n. sp. is proposed for the parasite.

Davidson (A. M.), Dowding (Eleanor S.), & Buller (A. H. R.). **Hyphal fusions in dermatophytes.**—*Canadian Journ. of Res.*, vi, 1, pp. 1–20, 3 pl., 22 figs., 1932.

A detailed account is given of cultural experiments with three dermatophytes, namely, *Microsporon audouini*, *M. lanosum*, and *Trichophyton gypseum*, isolated from clinical cases, the results of which showed that fusions were formed between hyphae of the same species whether isolated from one or different patients, but were not produced between the hyphae of one species and those of any other species paired with it in culture. This was true for the three species enumerated above, and also when *T. gypseum* was paired with the very similar *T. granulosum* or with *Epidermophyton interdigitale* which is botanically indistinguishable from *T. gypseum*.

These results lead the authors to consider that the presence or absence of hyphal fusions may be of diagnostic value for the identification of species of dermatophytes, by pairing them with known stock cultures. The absence of fusion is considered to be evidence that the species mentioned above are distinct.

Pezzi (G.). **Contributo allo studio del 'piede di Hong-Kong'.** [Contribution to the study of 'Hong-Kong foot'.]—*Ann. Med. Nav. e Colon.*, xxxvii (ii), 5–6, pp. 713–722, 2 pl., 1931. [Abs. in *Trop. Dis. Bull.*, xxix, 4, p. 272, 1932.]

Twenty-five cases of 'Hong-Kong foot', a condition of interdigital eczema very prevalent in tropical countries and causing intense irritation, were treated by the writer at the Catholic Mission Hospital, Hankow, China. From seven of the patients he isolated *Epidermophyton* [*Trichophyton*] *rubrum* and from the remainder *E. inguinale* [*E. floccosum*: *R.A.M.*, xi, p. 44], the latter being isolated also from the lesions in other parts of the body in four cases.

Agostini (Angela). **Miceti della Cirenaica.** [Fungi of Cyrenaica.]—Reprinted from *Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV, iii, 10 pp., 3 figs., 1931. [Latin summary.]

In this paper the author gives brief notes on 14 species of fungi sent for examination from the province of Derna in Cyrenaica, all of which are stated to be new records for that province. Eleven of these organisms were isolated from lesions on man or animals, and two of these, namely, *Aspergillus oryzae* from an eczema of the auricular canal in man, and *Acrostalagmus cinnabarinus* from an abscess of the mammary gland in a mare, are reported as human and animal pathogens, respectively, for the first time, as far as the author is aware.

Kochman (J.). **Choroby Róż.** [Rose diseases.]—Reprinted from *Choroby Roślin* [*Plant Diseases*], Warsaw, i, 3–4, 25 pp., 2 pl., 12 figs., 1931. [English summary.]

This is a semi-popular account (including some notes of local interest) of the chief parasitic diseases of the rose in Poland, namely, mildew (*Sphaerotheca pannosa*), black leaf spot (*Marssonina rosae*), rust (*Phragmidium subcorticium*) [*P. mucronatum*], downy mildew (*Peronospora sparsa*), brown leaf spot (*Septoria rosae-arvensis* and *S. rosarum*), grey rot of the flowers (*Botrytis cinerea*), stem canker (*Coniothyrium wernsdorffiae*), and crown gall (*Bacterium tumefaciens*). Recommendations for the control of these diseases are also given.

Blattný (C.) & Vukolov (V.). **Novotvary na kořenech Ruže (Rosa).** [Neoplasms on the roots of the Rose (*Rosa*).]—*Ochrana Rostlin*, xi, 6, pp. 169–175, 3 figs., 1931.

In this preliminary note a brief account is given of coralloid, lobate outgrowths which were observed in the autumn of 1931 on the roots of several varieties of roses grown in a commercial nursery near Prague, and which were macroscopically very reminiscent of the similar formations on the roots of the alder, *Eleagnus*, and *Hippophaë*, attributed by some to the activity of endotrophic species of *Actinomyces* [cf. *R.A.M.*, vii, p. 592 ; x, p. 476]. Examination of the rose outgrowths revealed the presence in them of fungal elements, the characters of which point to their belonging to an Actinomycete, the closer study of which is reserved for the future. Considerable variations were found in the size and frequency of these neoformations on the different varieties of roses, ranging from almost complete immunity in the dog rose (*Rosa canina*) to high susceptibility in the varieties Louise Sauvage and Mosel, in which the galls were very numerous and attained a diameter of 2·6 cm. in the former and up to 4 cm. in the latter.

As far as the authors are aware this is the first report of such galls on the rose. On the plots on which the roses were attacked, young trees of the alder, *Eleagnus*, and *Hippophaë* had been raised two years previously, without, however, developing outgrowths on their roots. The same varieties of roses grown in neighbouring plots remained immune. The rose neoformations appeared to check to some extent the initial normal growth of the young plants, more particularly of the varieties apparently exhibiting resistance, but the presence of numerous and large outgrowths did not seem to affect adversely the later health of the more susceptible ones. Most of the neoformations appeared to develop at or from the points where the roots of the young plants had been pruned before planting.

Schmidt (A.). **Kräuselkrankheit bei Pelargonien.** [Curl disease of *Pelargonium*.]—*Gartenflora*, lxxxi, 2, p. 40, 1932.

The cause of the leaf curl disease of *Pelargonium*, which was responsible for severe damage in Germany in 1931, is stated to be still obscure [*R.A.M.*, x, p. 461]. Many horticulturists attribute it to fungous infection, but in the writer's opinion the symptoms point rather to invasion by the leaf bug (*Lygus*). Good control has been

obtained by spraying with quassia and soft soap, veneta, or parasitol at 1 per cent. and with vomasol at 0·5 per cent. [ibid., x, pp. 705, 735].

Massey (L. M.) & Tilford (P. E.). **Cyclamen stunt.**—Abs. in *Phytopath.*, xxii, 1, p. 19, 1932.

Cyclamen stunt was observed in New York in 1926 and in Ohio in 1929, and is also known to occur in Pennsylvania, New Jersey, and California. Affected plants are conspicuously stunted, with small, sometimes yellow leaves, abnormally short petioles and peduncles, and flowers characteristically open below the leaves. Reddish-brown necrotic areas occur in the corm tissues, mostly in the crown but at times extending as far as the petioles, peduncles, and larger roots. The causal organism of the disease, as established by successful inoculations, is a hitherto undescribed *Cladosporium*, for which the name *C. cyclaminis* n. sp. is proposed. Growth in culture is slow, and results on potato-dextrose agar in a stroma-like black thallus, commonly covered with a greyish-white aerial mycelium. The hyaline to brown, non- to uniseptate spores, measuring 17·75 by 4·3 μ, are found in culture in 4 to 7 days, acrogenously, singly or in short chains, on short, rarely branched conidiophores.

Weber (Anna). **Løgsygdomme.** [Bulb diseases.]—Reprinted from *Aarbog for Gartneri, 1931*, 19 pp., 7 figs., 1932.

Notes (stated to be largely based on information obtained from Prof. E. van Slogteren in Holland) are given on the symptoms, etiology, and control of some fungous, bacterial, and non-parasitic diseases of flowering bulbs in Denmark, including tulip 'fire' (*Botrytis tulipae*) [*R.A.M.*, xi, p. 108]; sclerotial disease of tulips (*Sclerotium tuliparum*) [ibid., xi, p. 376]; white disease of tulips, hyacinths, and narcissi (*Penicillium corymbiferum* and probably other species of *Penicillium*) [ibid., viii, p. 42]; 'falling' disease of tulips [ibid., ix, p. 528]; yellow rot of hyacinths (*Phytomonas* [*Pseudomonas*] *hyacinthi*) [ibid., x, p. 598]; *Fusarium* disease of narcissus (*F. orthoceras* according to Feekes [ibid., x, p. 794] but attributed by van den Broek and Schenk in Ziekten en beschadigingen der tuinbouwgewassen, 1925, to *F. elegans*); narcissus 'smoulder' (*B. narcissicola*) [ibid., ix, p. 40; or *S. perniciosum*: ibid., xi, p. 376]; root decline of narcissi and hyacinths caused by *Cylindrocarpon radicicola* and *F. culmorum*, respectively [ibid., x, p. 795]; and *Botrytis* disease of snowdrop (*B. galanthina*) [ibid., x, p. 294].

Fergus (E. N.). **An analysis of Clover failure in Kentucky.**—*Kentucky Agric. Exper. Stat. Bull.* 324, pp. 443–476, 2 graphs, 1 map, 1931.

This is a report of the continued study of the causes of the failure of red clover (*Trifolium pratense*) in Kentucky [*R.A.M.*, vi, p. 558], each of the contributing factors being briefly discussed separately. Low fertility of the soil, although responsible for a fair proportion of partial failures of the crop, causes relatively few complete failures, since poor soils are usually avoided. Winter

injury to the plants is considered to be probably the most common cause of the trouble. Southern anthracnose (*Colletotrichum trifolii*) [ibid., viii, p. 176] is frequently an important contributory and occasionally the only cause of complete failure, particularly of north-western Kentucky home-bred clovers; it is also severe on northern domestic and on European and Chilean varieties. Northern anthracnose (*Gloeosporium caulivorum*) [*Kabatiella caulivora*: loc. cit.] does most damage to southern Kentucky clovers. The black stem disease [ibid., viii, p. 726] is severe on European and attacks northern Kentucky varieties to some extent. Crown rot (*Sclerotinia trifoliorum*) [ibid., xi, p. 246] is much more injurious to some clovers than to others, but so far no correlation has been established between susceptibility and the place of origin of the host plant. The severity of root rot (the cause of which is not yet known) appears to be related more closely to the fertility of the soil than to the nature of the clover varieties.

Riker (A. J.) & Banfield (W. M.). **Studies on the development of crown gall, hairy root, and wound overgrowths in treated soil.**—*Phytopath.*, xxii, 2, pp. 167–177, 1 fig., 1932.

Typical crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) and hairy root (*P.* [*Bact.*] *rhizogenes*), have been induced at will in both steamed and natural sandy loam soil on nursery apple trees of the Wealthy variety in Wisconsin [*R.A.M.*, x, p. 165]. Inoculations with mixtures of the two organisms resulted in enlargements showing the features of both crown gall and hairy root, with a considerable range of mixed characters. Generally speaking, callus tissue on Wealthy apples does not appear to be an open infection court for either of these organisms.

Riker (A. J.), Hildebrand (E. M.), & Ivanoff (S. S.). **The development of crown gall, hairy root, and wound overgrowth in glass cylinders.**—*Phytopath.*, xxii, 2, pp. 179–189, 2 figs., 1932.

A detailed account is given of the writers' studies on the development of crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), hairy root (*P.* [*Bact.*] *rhizogenes*), and wound overgrowths on Wealthy and Yellow Transparent nursery apple trees kept under glass cylinders [see preceding abstract]. The results of the experiments indicated that the two bacterial diseases possess distinctive features that may be induced by inoculation with the appropriate organisms under rigidly controlled conditions, whereby the possibility of a mixture of causal agents is virtually excluded. The best responses were secured by treatments made before 1st July, and incubation periods of at least two months were found to be desirable.

Palmiter (D. H.). **Variability of Venturia inaequalis in cultural characters and host relations.**—Abs. in *Phytopath.*, xxii, 1, p. 21, 1932.

Monoconidial cultures of *Venturia inaequalis*, isolated from 14 apple varieties from four States showed cultural differences not correlated with the locality or variety from which they were

isolated. Various species of *Malus* [*Pyrus*] were infected by one or more of these cultures in greenhouse tests, but inoculations on *P. floribunda* and some others failed. The Yellow Transparent apple variety was infected by 5 strains and resistant to 4; McIntosh, infected by 2 and resistant to 3; Dudley and Missouri Pippin, infected by 3 and resistant to 2; Hubbardston Nonsuch, infected only slightly by 3 and resistant to 2 of the cultures. The other 15 varieties inoculated proved susceptible to all the cultures.

CURZI (M.). **Malattie del Pesco caratterizzate da filliscosi ('Phony disease' e 'malattia pennacchio').** [Peach diseases characterized by abnormal foliage development ('Phony disease' and 'plume disease').]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 3, pp. 221–243, 2 pl., 7 fig., 1931.

Early Elberta peach trees in numerous localities in Italy, especially Tuscany and central Italy, have in recent years developed a condition, restricted exclusively to this one variety (even other Elbertas remaining unaffected), which somewhat resembles phony disease [*R.A.M.*, ix, p. 727; x, p. 643] and is known locally, from the characteristic appearance of severely affected branches, as 'plume' disease.

The disease differs from phony disease [the symptoms of which are fully described], in spite of a superficial resemblance in the shortened branches with a typical 'court noué' appearance [cf. ibid., x, p. 433] and an abnormally vigorous leaf development, in several particulars. Thus, the condition is most severe on young trees, noticeably less so on older ones, and is not present at all or very slightly on some of the terminal branches. Also, the symptoms are limited to areas in which lesions are found in the axillae of the leaves. On the same tree and the same branch there may be normal and abnormal leaves and twigs. The last shoots developed at the end of September or in October do not show the court noué appearance and frequently bear no lesions in the axillae; the leaves droop slightly along the midrib like those of healthy trees but are never rigid, with an almost straight midrib and the blade rolled up so as to form a kind of gutter or pipe like those on the shortened part of the branch.

The stalk of the diseased leaves is thickened, owing to a hypertrophy of the cortical parenchyma cells. Beneath the insertion of the leaf the cortical cylinder of the branch is more developed than the part a very little above, and apparently this difference in the growth of the branch produces the dark lesion present in the axilla which is in the form of an isosceles triangle with the base towards the bud and the apex upward. In this triangular area the cortex of the affected branches is thinner than normal and the overlying epidermis is lacerated. In severe cases the buds may be partially or completely destroyed.

The author found no trace of any fungal parasite in these lesions. From the characters of the condition, which bears a certain resemblance to that caused in America by the mite *Tarsonemus waitei* Banks, he thinks that it is very probably due to infestation by red spider (*Tetranychus telarius*), an acarus

resembling which was found on the lesions of some of the affected trees.

VOGEL (F.) & WEBER (E.). **Zur Blattrandkrankheit der Johannisbeere.** [On leaf scorch of the Currant.]—*Gartenbauwissensch.*, v, p. 457, 1931. [Abs. in *Fortschr. d. Landw.*, vii, 8, p. 234, 1932.]

Observations and experiments at Weihenstephan, Bavaria, showed that healthy currants have a higher average weight and a higher sugar and acid content than those from leaf scorch bushes [*R.A.M.*, xi, p. 312], whereas the chlorine content of diseased fruit is about five times higher than that of the sound. This fact points to injury by chlorine, a theory supported by the increased water absorption and salt accumulation in the wood of diseased bushes. Potash deficiency, however, is also indicated by the reduced salt content of the leaf ash and of the subsoil below the affected bushes.

PLAKIDAS (A. G.). **Infection studies with Mycosphaerella fragariae and Diplocarpon earliana.**—Abs. in *Phytopath.*, xxii, 1, p. 21, 1932.

The infection of strawberry leaves by *Mycosphaerella fragariae* and *Diplocarpon earliana* [*R.A.M.*, x, p. 254] has been found to take place primarily through the lower leaf surface. *M. fragariae* enters through the stomata, and there is an apparent correlation between the amount of infection and the number of stomata, which in the Klondike variety averaged 3·16 and 14·77 per sq. mm. on the upper and lower surfaces, respectively. *D. earliana* does not seem to enter through the stomata, but its exact mode of penetration has not been determined.

KERVEGANT (D.). **Le Bananier à la Martinique.** [The Banana in Martinique.]—*Agron. Colon.*, xxi, 169, pp. 6–12, 1 pl., 1932.

The causal organism, *Fusarium cubense* [*F. oxysporum*: *R.A.M.*, x, p. 626], of Panama disease is reported to have been observed by Mr. D. Gent on Makanguia bananas in various parts of Martinique; as this variety is not extensively cultivated, the disease does relatively little damage, but the presence of the fungus renders it impossible to lay down any large plantation of Makanguias.

In one young banana plantation made without previous soil disinfection on old cacao land the author noted a serious case of foot rot due, apparently, to *Lasiodiplodia* [*Botryodiplodia*] *theobromae*.

The following caused rots of gathered banana fruits and fruit stalks: *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *B. theobromae*, and *Gloeosporium musarum*.

DAMPF (A.). **Mexico: Panama disease of Bananas.**—*Internat. Bull. of Plant Protect.*, vi, 2, p. 24, 1932.

Fusarium cubense var. *inodoratum* [*F. oxysporum*], the causal organism of Panama disease [see preceding abstract], is reported on banana plants collected in the State of Tamaulipas, Mexico.

WARDLAW (C. W.). **Banana diseases. IV. Notes on 'black-tip' disease in Trinidad; Helminthosporium torulosum (Syd.) comb. nov. Ashby.**—*Trop. Agriculture*, ix, 1, pp. 3–6, 4 pl. (facing pp. 4 & 5, and 28 & 29), 1932.

Continuing his studies of banana diseases [*R.A.M.*, xi, p. 382], in this paper the author deals with the 'black-tip' disease of the fruit caused by *Helminthosporium torulosum* [ibid., x, p. 806]. The fungus (the synonyms of which are *Cercospora musarum* and *Brachysporium torulosum* Sydow) has been observed attacking the fruits of the Canary and Cavendish (Governor) varieties of *Musa cavendishii*, and on Lacatan and Gros Michel bananas; it also causes leaf spots on the Cavendish banana. In culture on a standard medium containing 2·5 per cent. sucrose plus mineral salts it forms normal conidia measuring 30 to 100 by 12 to 16 μ, while on a medium containing 0·5 per cent. sucrose the largest measured 160 by 20 μ, intermediate ones 85 by 18 μ, and the smaller 50 to 60 by 14 μ. The conidia originate by a budding process at the tip of the conidiophore, transverse septa being formed successively as the spore increases in length, until as many as 11 or 12 may be present. Ashby's original description of the conidia as smoky-olive in colour, pear-shaped, widest above the base and narrowing thence to a blunt point is most characteristic of the shorter, stumpy form. The conidiophores, according to age, may be simple or considerably developed. The type of growth in pure culture and the measurements obtained for the conidia were shown to be considerably influenced by the composition of the nutrient medium, especially by the source of carbon and nitrogen. High asparagin concentrations, in particular, restricted sporulation and caused the appearance of a number of abnormal features in the conidiophores and conidia.

MARTIN (H.). **The chemistry of insecticides and fungicides.**—*Journ. South-Eastern Agric. Coll., Wye*, Kent, xxix, pp. 31–34, 1932.

Further experiments conducted at Wye, Kent [*R.A.M.*, xi, p. 253], showed that all the glyceride oils tested were fungicidal towards hop powdery mildew [*Sphaerotheca humuli*], this property being inherent in the glyceride, not due to adventitious material, and apparently greatly influenced by the manner of emulsification. Field trials of the action of these oils upon apple and gooseberry varieties intolerant of sulphur [cf. ibid., xi, p. 381] gave promising results with certain naphthols, evidence also being obtained that the action of these compounds upon *S. humuli* and the hop leaf is intimately related to their chemical structure.

In response to inquiries from hop growers as to the possibility of combining nicotine with Bordeaux mixture to simplify the control of downy mildew [*Pseudoperonospora humuli*: see below, p. 471] and insect infestation, experiments were conducted to obtain a satisfactory combination of contact insecticides with copper fungicides. As the spreading properties of soap are destroyed on its addition to Bordeaux mixture by the excess lime present, and as it would appear that casein and gelatine when used with Bordeaux mixture seriously interfere with the formation of soluble copper after

spraying, the nature of the spreader offered difficulty; this was, however, solved by the discovery that sulphite lye may safely be used. This may be bought in concentrated form as a viscous liquid or as a powder so cheaply that its cost per 100 galls. of spray is less than sixpence. Field trials were conducted to ascertain whether in the presence of sulphite lye the use of a coarser spray than usual (this appears to be necessary for insect control) would give a sufficiently lasting Bordeaux deposit; good results were obtained, but further trials are necessary before a definite recommendation can be made to growers.

An alternative method of incorporating a contact insecticide with the protective fungicide is by means of an oil solution of the former emulsified with Bordeaux mixture. This was found to be satisfactory, and field trials upon potatoes showed that the adhesiveness of the Bordeaux deposit was greatly increased by the presence of the oil. Further investigations are in progress along these lines.

LIMING (O. N.). **The relation of pentathionic acid and its component constituents to the toxicity of sulphur fungicides.**—*Phytopath.*, xxii, 2, pp. 143–165, 5 figs., 1932.

Continuing his studies on the relation of pentathionic acid to the toxicity of sulphur fungicides [*R.A.M.*, ix, p. 734], the writer conducted experiments [with a special apparatus which is described] on the physical and chemical nature of volatilized sulphur. The rate of vaporization of the volatile product of sulphur was found to be affected by temperature, a rise from 23° to 93° C. causing an increase of about 20,000 times. The use of glass-wool filters showed that the sulphur was given off in a gaseous state. Sulphur vapour itself was found not to be toxic to the spores of *Sclerotinia cinerea* and *Cladosporium fulvum*, but after standing for 24 hours the condensation products (recrystallized sulphur) became toxic and reduced the germination percentages in *S. cinerea* from 89·4 to 27·4 per cent., from 91 to 12·2 per cent., and from 75·7 to 0·9 per cent. with sulphur vaporized at 80°, 110°, and 200°, respectively.

Sulphur dioxide occurs only in traces in ground sulphur and in such concentrations is not toxic to the spores of *S. cinerea*. The formation of this gas appears to be favoured by light and high temperatures; as a transitory factor in the production of pentathionic acid, it probably plays an important part in the toxicity of sulphur fungicides. Ground sulphur contains no hydrogen sulphide. Traces of this gas are produced from sulphur by various higher plants [which are enumerated], as well as by a number of fungi, including *S. cinerea*, *S. sclerotiorum*, *Rhizoctonia* [*Corticium*] *solani*, *Venturia inaequalis*, *Botrytis cinerea*, and several others, but it is not toxic to fungi at such concentrations.

On the other hand, pentathionic acid, a natural oxidation product of sulphur, of which about 0·0002 millimol occurs in 1 gm. of National 300-mesh sulphur, was found to be toxic at a strength of 0·0068 N. in a buffer-mannite solution to the spores of *S. cinerea*, *B. cinerea*, and several other fungi. This substance, however, is not sufficiently volatile in dilute solutions (0·05 N.) to be toxic at a distance, e.g., to spore suspensions held 4 mm. above the acid.

The toxicity of sulphur filtrates (0·006 N. from ground sulphur and 0·008 N. from flowers of sulphur) previously reported [loc. cit.] to the spores of *S. cinerea* is attributed to a combination of the vaporization of sulphur and the oxidation of the condensed vapour. Hydrogen sulphide is believed to be a contributory factor in these reactions [cf. ibid., x, p. 395]. The pentathionate ion was found to be stable in weak acid and alkaline solutions, but it is toxic to *S. cinerea* only in the former. The toxic action appears to be governed by the condition of the fungus tissue, probably the amphoteric substances, rather than by that of the pentathionate ion.

Sabalitschka (T.). **Schutz der Lebensmittel gegen Mikrobenbefall durch unschädliche Konservierungsmittel.** [Protection of foodstuffs against microbial infection by innocuous preservatives.]—*Mitt. Gesellsch. für Vorratsschutz,* viii, 1, pp. 6–10, 1932.

The ethyl ester of the p- oxybenzoic acid is on the market under the name of nipagin A, the propyl ester being known as nipasol, while a combination of both, nipakombin (J. Penner A.-G., Chemische Abteilung, Berlin-Schöneberg), has been found superior to either alone in the protection of foodstuffs against decay due to fungi, bacteria, and yeasts. Used at a strength of 0·075 per cent., nipakombin preserves unsweetened cherries, apple, plum, and apricot jam, strawberry, gooseberry, raspberry, and currant pulp, and the like; at 0·06 per cent. it is effective in the preservation of raw cherry and raspberry juice, malt extract solution, and cider, and at 0·04 per cent. in that of unsweetened fruits, jams, and juices. Among other foodstuffs for which nipakombin may be used are preserved fish, pastries, sweets, lemonade, &c., while it is claimed further to exercise a preservative action on tobacco, and may also find application in the technical, pharmaceutical, and cosmetic industries.

Cruess (W. V.) & Irish (J. H.). **Further observations on the relation of P_H value to toxicity of preservatives to micro-örganisms.**—*Journ. of Bact.,* xxiii, 2, pp. 163–166, 1932.

In a previous paper (*Journ. of Bact.,* xvii, p. 363, 1929) it was shown that much more sodium benzoate was required to prevent the growths of yeasts, moulds, and bacteria at P_H values near neutrality (P_H 5 to 8) than in the acid range of P_H 2·5 to 4·5. The present studies were conducted to determine the approximate concentrations of benzoic, salicylic, sulphurous, and ácetic acids necessary to prevent the growth of *Penicillium glaucum*, *Saccharomyces ellipsoideus*, and bacteria obtained from fruit juice. It was found that, on an apple juice medium, more than 150 times as much sodium salicylate was required to prevent growth at P_H 7 as at P_H 2·5. At P_H 7 none of the concentrations of sodium salicylate used appreciably affected the fermentation rate, which was retarded by small concentrations of the chemical at P_H 2·5 and 3·5. Similar data were obtained in respect of the other acids tested, whereas the preservative action of formaldehyde and sodium chloride were little affected by the P_H value of the medium.

Department of Scientific and Industrial Research. Water pollution research. Summary of current literature, v, 1, pp. 1–36, London, H.M. Stationery Office, 1932.

The present number of the summary of current literature on water pollution research contains 123 abstracts on the treatment of water supplies, analysis and examination of water, sewage, trade waste waters, pollution of natural waters, and miscellaneous aspects of water contamination.

ROGERS (L. A.). **The American Type Culture Collection.**—*Journ. of Bact.*, xxiii, 2, pp. 193–194, 1932.

The grant made by the Rockefeller Foundation to the American Type Culture Collection having now expired and no fresh sources of income being available under the present conditions, it has been found necessary to increase the price of cultures from $1 to $2. During the seven years since its establishment at the John McCormick Institute for Infectious Diseases, the activity of the Collection has steadily increased, the number of cultures sent out in 1931 being 5,019 (including 350 fungi for research and industrial purposes) as compared with 1,540 in 1925.

LINK (G. K. K.) & RAMSEY (G. B.). **Market diseases of fruits and vegetables. Potatoes.**—*U.S. Dept. of Agric. Misc. Publ.* 98, 62 pp., 15 pl. (13 col.), 1932.

This bulletin is stated to be the first of a series 'designed to aid in the recognition and identification of pathological conditions of economic importance affecting fruits and vegetables in the channels of marketing, with a view to facilitating the market inspection of those food products and reducing and preventing losses from such conditions'. Popular notes are given on the symptoms, etiology, and control of a number of well-known fungous, bacterial, and physiological diseases affecting potato tubers in the United States. The symptoms of many of these are illustrated in colours.

A bibliography of 196 titles is appended.

MÜLLER (D.). **Die Assimilation der blattrollkranken Kartoffelpflanzen.** [The assimilation of leaf roll-diseased Potatoes.]—*Planta*, xvi, 1, pp. 10–15, 1 graph, 1932.

A comparative study was made at the Laboratory of Plant Physiology, Copenhagen University, Denmark, of the stomatal dimensions, respiratory intensity, and carbon dioxide assimilation of healthy and leaf roll Magnum Bonum potato plants [*R.A.M.*, xi, p. 319].

The width of the stomatal apertures was found to be less in diseased than in healthy plants. Respiratory intensity per unit area was approximately equal in both series. Carbon dioxide assimilation was found to be much reduced in diseased as compared with healthy leaves, the maximum intensity of this process in the former amounting to only 2 to 2·5 mg. CO_2 per 50 sq. cm. (unilateral) per hour at 20° C. and normal pressure, against 7 mg. in the latter. The figure for diseased but not rolled leaves was

intermediate (5 mg.). No improvement in the assimilatory capacity of rolled leaves was induced by darkening the plants in order to eliminate the starch. Possibly the low yield of dry substance from leaf roll potatoes is partially or entirely explicable on the basis of reduced assimilatory intensity.

NEUWEILER (E.). **Switzerland: Potato wart disease.**—*Internat. Bull. of Plant Protect.*, vi, 1, pp. 5–6, 1932.

Sporadic outbreaks of potato wart (*Synchytrium endobioticum*) have occurred in Switzerland since the first discovery of the disease in that country in 1925 [*R.A.M.*, v, p. 627]. All the 13 centres of infection detected between 1926 and 1930 were destroyed by boiling the diseased crops, disinfecting storage premises and implements, and putting the infected fields down to grass for ten years. In 1931 the fungus was reintroduced into eight cantons on large consignments of the reputedly immune Alma variety from East Prussia, and three further centres of infection have been found in two other cantons in Alma, Frühe Rosen, and Kaiserkrone potatoes. Drastic measures, including the use of resistant varieties, will be adopted to check the spread of the disease [cf. ibid., x, p. 816].

NEWTON (W.). **The physiology of Rhizoctonia.**—*Scient. Agric.*, xii, 3, pp. 178–182, 3 graphs, 1931.

Growth temperature studies [by a method which is indicated] showed that the lethal temperature period for cultures of *Rhizoctonia* [*Corticium*] *solani* obtained from infected potato tubers in 15 widely separated localities in British Columbia was one hour at 50° C. Shorter periods at this temperature caused a lag in the growth rate when the cultures were transferred to an incubator at 25° C. No permanent attenuation of vigour occurred as a consequence of maintaining the cultures at temperatures near the lethal point, the growth rates being temporarily inhibited, but the cultures afterwards re-acquiring their original vigour. Thus the effectiveness of the hot formaldehyde or hot mercuric chloride treatment depends entirely upon the greater penetration or the greater toxicity of the disinfectants at the higher temperatures and not upon any direct effect of heat upon the fungus. As potato tubers failed to make any significant growth after one hour's immersion in water at 50°, and were severely injured when immersed for the same period at 45°, a hot-water treatment is useless for the control of *C. solani*. Further, the sclerotia of the fungus germinated after being removed from tubers immersed for one hour at 55°, the lethal temperature period being one hour at 60°.

A procedure [which is described] was devised to establish the optimum temperature and the growth rate at any temperature as critical constants. The growth temperature graph for *C. solani* reaches zero at 6° and at 32° and shows an optimum growth rate at 25°; its shape indicates that the temperature coefficient progressively increases with decreasing temperature. When tube cultures were transferred from 8° to 25° a constant growth rate was not obtained until the fourth day.

Elmer (O. H.). **Pathogenic and cultural comparisons of strains of Rhizoctonia solani.**—Abs. in *Phytopath.*, xxii, 1, pp. 8–9, 1932.

Two main groups of strains of *Rhizoctonia* [*Corticium*] *solani* are distinguished, the most commonly found producing necrotic lesions on potato stems. The strains of the second group produce superficial, fleck-like lesions on potato stems, and cause arrested apical growth of the emerging sprouts. Such plants form lateral sprouts of which the apical growth may in turn be checked. On artificial media the strains of this second group produce numerous small, white mycelial aggregations of a mealy appearance. Other strains outside these groups also occur.

Tullis (E. C.). **Ophiobolus oryzinus on Rice in Arkansas.**—Abs. in *Phytopath.*, xxii, 1, p. 28, 1932.

Ophiobolus oryzinus, originally found by C. F. Baker on rotting straw in the Philippine Islands, has been shown to cause a disease of rice in Arkansas. In artificial inoculation tests, *O. oryzinus* was pathogenic on Fortuna and Blue Rose rice plants in the seedling and heading stages and on red rice in the former stage, some of the plants being killed outright, while others were injured through loss of leaf area. Infected plants did not produce tillers until after the heading of the first culm. The host was invaded by direct mycelial penetration of the epidermis of the basal leaves, appressoria being formed.

Tullis (E. C.). **Helminthosporium sigmoideum, the conidial stage of Sclerotium oryzae.**—Abs. in *Phytopath.*, xxii, 1, p. 28, 1932.

Sclerotium oryzae, the causal organism of stem rot of rice [see above, p. 433], has been found by investigations in Arkansas to produce a conidial stage, which was identified as *Helminthosporium sigmoideum* [ibid., ii, p. 230]. Conidia of *H. sigmoideum* were also found in a herbarium specimen of *S. oryzae* collected in Italy by Briosi and Cavara. The genetic connexion of the two stages has been demonstrated in inoculations and in cultural studies with both stages. Blue Rose rice seedlings grown aseptically on maize meal agar in test tubes and inoculated with sclerotia of *S. oryzae* were killed by the fungus. Conidia of *H. sigmoideum* subsequently developed on these seedlings, germinated, infected fresh rice seedlings, and produced in them and on agar the typical sclerotia of *S. oryzae*. This entire life-cycle (sclerotia, mycelium, conidia, mycelium, sclerotia) has been followed under controlled laboratory conditions, as well as on plants grown aseptically on agar and in the soil.

Een nieuwe goedkoop toestel voor meeldauwbestrijding. [A new, cheap apparatus for mildew control.]—*De Bergcultures*, vi, 6, pp. 159–162, 1932.

Particulars are given of the construction and application of the German Sulfurator apparatus [*R.A.M.*, xi. p. 254], which it is hoped will prove useful in the control of rubber mildew [*Oidium heveae*: ibid., x, p. 749] in Java. The machine is obtainable from

the Schlieper Company at an inclusive price of 265 florins. Air is driven by a bellows through sulphur melted at a high temperature and carries the latter in a very finely divided cloud to a height sufficient to reach the crowns of the tallest rubber trees. The sulphur is deposited in finer and more evenly distributed particles than that from the ordinary dusting machines and adheres to the leaves very well even when rain falls on it. About 10 kg. sulphur can be liberated per hour. The machine weighs about 50 kg. and can be carried by two coolies.

PFÄLTZER (A.). **De Sulfurator.** [The Sulfurator.]—*De Bergcultures*, vi, 8, p. 202, 1932.

It is pointed out that no actual tests in rubber mildew [*Oidium heveae*] control have yet been conducted with the Sulfurator apparatus [see preceding abstract] in Java, so that any reports as to its efficacy for this purpose should be received with caution. Experiments in which sulphur was applied to the trees after the close of the mildew campaign indicate that, while the general principle of the apparatus is correct, there are various drawbacks connected with its use. Thus, the clouds of sulphur are readily dissipated by the wind, and the layer of sulphur deposited on the treated leaves is so thin as to be barely discernible. When these defects are remedied the machine should prove useful on economical grounds.

WAKSMAN (S. A.). **Principles of soil microbiology.**—xxviii + 894 pp., 15 pl., 1 fig., 3 diags., 79 graphs, London, Baillière, Tindall & Cox, 1931.

Although only four years have elapsed since the publication of the first edition of this standard work [*R.A.M.*, vi, p. 507], a number of changes are necessitated by the many contributions to the knowledge of the subject made during this period. In order to bring the book up to date, some of the chapters have been entirely rewritten, especially those dealing with the mycorrhizal fungi and the soil as a medium for plant and animal parasites, while new chapters have been added treating of the rôle of micro-organisms in the decomposition of organic matter in green and stable manures and in the formation and decomposition of peat and forest soils, as well as of the relation between plant growth and the activities of soil micro-organisms. The necessary condensation was effected by the omission of some of the text not directly bearing on the subject under consideration. As in the previous edition, the interdependence between the activities of micro-organisms and the chemical transformations in the soil is specially emphasized.

GEHRING (A.). **'Sand drown' Erkrankungen von Tabak und Mais in Abhängigkeit vom Kalk- und Magnesia-Gehalt des Bodens.** ['Sand drown' diseases of Tobacco and Maize conditioned by the lime and magnesium content of the soil.]—*Ernährung der Pflanze*, xxviii, 6, pp. 101–104, 1932. [English summary on p. 120.]

In connexion with his work at the Brunswick Agricultural

Experiment Station on the importance of magnesium as a fertilizer constituent, the writer examined 17 soil samples from North and South Carolina and Massachusetts, in which 'sand drown' of tobacco and maize was known to occur [*R.A.M.*, x, pp. 686, 761]. The results of this investigation confirmed previous observations to the effect that the magnesium-deficient soils predisposing to this disease are equally poor in lime, and a parallel is drawn between sand drown and the pathological symptoms exhibited by oats and rye on acid soils in Germany [ibid., xi, p. 101].

HINKS (G. R.). **Soil sterilizing plant at Carrington, Cheshire.**—*Gard. Chron.*, xci, 2355, p. 128, 1 fig. (on. p. 127), 1932.

A description is given of the soil sterilizing plant installed at the Central Propagating Department, Carrington, Cheshire, in 1930 for the Manchester Corporation. The plant is of the two-cell type, each cell being 4 ft. 9 in. long, 3 ft. wide, and 1 ft. 9 in. deep, and capable of holding a cartload of soil (about one ton). In each cell the steam is blown into the soil from three rows of galvanized pipes, 1 in. in diameter, the steam being kept on from 30 to 45 minutes; after treatment the soil is allowed to lie for a period of three weeks to three months. The cost of installation of the plant, including boiler, injector, feed tank, &c., was about £130. Steam is used at a pressure of about 80 lb. per sq. in. The consumption of coal, mixed with a small amount of coke, is about 1½ cwt. for an eight-hour day. Weeding costs are considerably reduced by soil sterilization on these lines, four men now being able to clear the same number of frames in one hour as formerly in four or five days, and the growth of the plants is greatly improved.

SALMON (E. S.) & WARE (W. M.). **The downy mildew of the Hop in 1931.**—*Journ. Inst. of Brewing*, N.S., xxix, 1, pp. 37–44, 1932.

In 1931, owing to the persistent wet weather, the outbreaks of hop downy mildew [*Pseudoperonospora humuli*] were more severe than any hitherto experienced in England [cf. *R.A.M.*, x, p. 406]. In Kent the first basal spikes were observed on 15th April, and on 26th May infection of the lower leaves of the bine was noticed. Where the spikes were not properly removed and spraying was omitted or inadequately carried out, the leaves near the cones became infected and spores passed from them to the cones, turning the latter brown, while the burr (newly formed cones) was sometimes attacked and destroyed. Hundreds of acres had to be abandoned on account of downy mildew, and still more were picked unripe. Satisfactory control was again obtained in 1931 by three applications of Bordeaux mixture as previously recommended [loc. cit.]. The hops may safely be sprayed throughout the burr period, but on no account should the mixture be applied to the ripening cones [ibid., x, pp. 127, 687].

The alleged resistance of the Fuggles variety suffered a further decline in 1931, and growers are advised to spray this variety in future in order to secure a fully mature and healthy crop. During

the period under review, many Fuggles were picked long before ripening for fear of infection by mildew, with consequent loss of quality. In 1931 the well-known Saaz variety, hitherto regarded as virtually immune from cone infection by *P. humuli* [ibid., viii, p. 603], was also reported to be attacked in Czecho-Slovakia (*Petit Journ. du Brasseur*, xxxix, p. 1001, 1931).

Bell (A. F.). **Dwarf disease of Sugar-cane.**—*Queensland Bur. of Sugar Exper. Stations, Div. of Path. Bull.* 3, pp. 3–12, 6 figs., 1932.

This is a full account of the 'dwarf disease' of sugar-cane in the Mackay district of Queensland, apparently confined to about a dozen farms, a summarized description of which has already been noticed from another source [*R.A.M.*, xi, p. 326]. In addition to the information contained in the previous paper, it is stated that histological examination showed that in the extremely stunted, grass-like plants resulting from primary infection, the major vascular bundles of the leaves may be considerably enlarged, very irregular in shape, and frequently fused with an adjoining minor bundle. As a rule, the chlorophyll-bearing sheath is incomplete and may be reduced to a very few cells: in extreme cases it may even be completely absent. Within the bundle there is an abnormal development of comparatively thin-walled lignified cells which frequently radiate through the bundle in two or more strands, bringing about distortion and altering the relative positions of the component tissues. Phloem may be almost completely absent and confined to one of the resultant sectors, or may be found scattered in more than one sector at the ends of the lignified strands. No definite abnormalities were seen in either stems or leaves of plants exhibiting what is believed to be secondary infection, in which the symptoms appear at some stage in the growth of the plant after the canes have formed.

So far all attempts to isolate a micro-organism from the diseased plants have given negative results, and all indications point to the disease belonging to the virus group. No correlation was established between the occurrence of the trouble and any particular soil type. There was some evidence to show that there is no prolonged masking of symptoms in the case of primary infection, and if this view is correct, comparatively slow secondary spread has been observed in a number of fields during the months of March and April. Attempts at mechanical transmission of the disease by Sein's method [ibid., ix, p. 678] have so far given negative results.

To prevent a dangerous spread of the trouble it is recommended carefully to examine all fields, especially those planted with P.O.J. 2714, P.O.J. 213, E.K. 28, and H.Q. 426 (Clark's Seedling) intended to serve as a source for further planting, and to reject all those in which even a single diseased stool is found. The disease has not been definitely proved to occur on the two last-named varieties, but suspicious symptoms have been reported on them.

[This paper is reproduced in *Queensland Agric. Journ.*, xxxvii, 1, pp. 9–17, 1932.]

COTTRELL-DORMER (W.). **Red-stripe disease of Sugar-cane in Queensland.**—*Queensland Bur. of Sugar Exper. Stations, Div. of Path. Bull.* 3, pp. 25–59, 1 col. pl., 11 figs., 1932.

This report is divided into two main sections, the first of which gives a full account of the author's investigation of the red stripe disease of the sugar-cane in Queensland. The results indicate the identity of this disease with the previously described local form of top rot [*R.A.M.*, x, p. 339], since symptoms characteristic of both were produced by inoculations with the causal bacterium, which was subsequently re-isolated from the experimental lesions. The most destructive form of the disease would appear to result from infection through the semi-mature internodes, while the mature portions of the sugar-cane stems appear to be much less susceptible.

The second section deals with the morphological and cultural characteristics of the organism responsible for the disease, whose index number, according to the 1929 descriptive chart of the Society of American Bacteriologists, is 5020-32020-1000. In spite of some minor differences, the Queensland organism is considered to be identical with *Phytomonas rubrilineans* [ibid., v, p. 133]. Its chief differences from the previous descriptions are that it does not liquefy gelatine and it turns milk alkaline. Its thermal death point was found to be about 51° C., and it was shown to be unable to survive ten minutes' exposure to direct sunlight. When kept in a dry cardboard box it retained its viability for a period of seven months, but attempts to isolate it from lesions which had been exposed to all kinds of weather for some three or four months in the field, gave negative results. Inoculation tests established the pathogenicity of the organism under controlled conditions to sorghum and broom millet [*Andropogon sorghum*], Sudan grass (*Sorghum sudanensis*) [*A. sorghum* var. *sudanensis*], Johnson grass (*S. halepense*) [*A. halepensis*], Tambuki grass (*S. verticilliflorum*), a native grass (*S. plumosum*) [*A. australis*], and maize.

The author also gives a brief description of a disease widely distributed in Queensland cane-growing areas, which he tentatively calls mottled stripe since its symptoms very closely agree with those of the mottled stripe disease described from Louisiana, and both are caused by a slightly curved, rod-shaped organism (*P. rubrisubalbicans*) [ibid., x, p. 129], with polar flagella. In Queensland (where it is so far of no economic importance) it occurs chiefly on the Badila cane which is considered to be resistant in Louisiana. In contradistinction to red stripe, the leaf lesions of mottled stripe are a pale yellow speckled to a greater or lesser extent with vermilion, and they bear no bacterial exudate; sometimes the stripes are almost entirely yellow, and at other times vermilion is the predominant colour. Mottled stripe has not yet been observed to produce a top rot of the sugar-cane.

[This paper is reproduced in *Queensland Agric. Journ.*, xxxvii, 1, pp. 23–40, and 2, pp. 98–114, 1932.]

CIFERRI (R.). **The criteria for definition of species in mycology.**—*Ann. Mycol.*, xxx, 1–2, pp. 122–136, 5 diags., 1932.

In connexion with a discussion on the ambiguity of the standards

in current use for the classification of fungi [cf. *R.A.M.*, ix, p. 492], the writer proposes three alternative criteria, based primarily on his studies on the Ustilagineae but applicable with certain modifications to other groups, viz., (1) the indication, by means of some recognized abbreviation, of the kind of species intended, e.g., m. for morphologic, ec., ecologic, pa., pathographic (effect of the parasite on the host as well as reaction of the latter to the parasite), and cu., cultural; (2) the arrangement of the different kinds of 'species' as inferior units of the 'mother species' or 'Sammelspecies' according to an agreed conventional scale; and (3) the adoption of trinary nomenclature, this being in the writer's opinion the most feasible suggestion and the one involving the minimum of radical changes.

THOROLD (C. A.). **A further preliminary list of Trinidad fungi.**—30 + viii pp., Government Printing Office, Port-of-Spain, 1931.

The first section of this pamphlet gives a list of the parasitic and saprophytic fungi collected up to 1930 in Trinidad, together with their synonymy and notes on their geographical distribution. The second section is an enumeration of the fungal and bacterial diseases of cultivated and other plants occurring in that island, arranged by their hosts. Both the fungi and their hosts are also indexed in alphabetical order.

WALLACE (G. B.). **Preliminary list of fungi or diseases of economic plants in Tanganyika Territory.**—*Kew Bull. Misc. Inform.*, *1932*, 1, pp. 28–40, 1932.

A list is given, in alphabetical order of the hosts, of the fungi and diseases (physiological and virus) affecting 58 plants of economic importance in Tanganyika Territory. The records (all of which have been made since 1927) are furnished with the author and reference to the original description, and the locality and date of collection.

SYDOW (H.). **Fungi chilenses a cl. E. Werdermann lecti. Pars secunda.** [Chilean fungi collected by E. Werdermann. Part II.]—*Ann. Mycol.*, xxx, 1–2, pp. 81–90, 1932.

Taxonomic and critical notes are given on twelve species of fungi (of which seven are new) collected in Chile, mostly on woody plants [cf. *R.A.M.*, vii, p. 673]. The new species are furnished with diagnoses in Latin and German.

SYDOW (H.). **Novae fungorum species. XXI.** [New species of fungi—XXI.]—*Ann. Mycol.*, xxx, 1–2, pp. 91–117, 1932.

Latin and German diagnoses, with critical notes, are given of 24 new species of fungi collected in Germany, India, China, Siam, the Philippine Islands, and Brazil [cf. *R.A.M.*, x, p. 342]. *Septoria carvi* n. sp., found producing spherical, yellowish or brownish spots and killing the leaves of *Carum carvi* in Westphalia, is characterized by depressed, globular pycnidia, 60 to 100 μ in diameter, with a simple, usually irregular pore, the membrane composed of 1 to 3 layers of thin-walled, very light olive-brown cells; and straight or rarely slightly curved, hyaline conidia, 18 to 45 by 0·8 to 1·3 μ, borne on conidiophores 2 to 3 μ in length.

Christoff (A.). Нѣколко нови растителни болести за България. [Some plant diseases new to Bulgaria.]—Reprinted from *Renseignements Agricoles*, Sofia, xi, 11–12, 18 pp., 3 figs., 1930. [German summary. Received May, 1932.]

This is an annotated list of plant parasitic bacteria and fungi [including three new species] which have been recorded of recent years, for the first time in Bulgaria. The bacteria include *Bacterium mori* on the mulberry [*R.A.M.*, x, p. 347], *Bact. papavericola* on the opium poppy [ibid., ix, p. 456], and *Bact.* [*Pseudomonas*] *pisi* [ibid., ix, p. 700] on the pea; artificial inoculations showed that under warm and moist environmental conditions the disease caused by the last-named organism takes only two days to develop.

Leptosphaeria dianthi n. sp. was found on the leaves of *Dianthus tristis* in association with *Alternaria dianthi* [ibid., x, p. 438], on the spots of which it formed small, black, dispersed, at first submerged and later erumpent perithecia, up to 50 μ in diameter, with a papillate ostiole. The asci are clavate, broadly cylindrical when mature, and 68 to 85 by 15 to 20 μ; they contain eight subdistichous, yellowish, oblong-ellipsoidal, straight or slightly bent, three- (rarely four-) septate spores, slightly constricted at the septa, and measuring 25 to 38 by 7·8 to 10·6 μ. *Aecidium anchusae*, the aecidial stage of *Puccinia dispersa* [*P. secalina*], was recorded on *Anchusa officinalis*. *Polyporus hispidus* was observed killing branches of the apple and of a species of *Juglans*. *Phyllosticta ruborum* was found causing leaf spots on a species of *Rubus*, and *Septoria ribis* [*Mycosphaerella grossulariae*] on red currants (*Ribes rubrum*). In 1928 black cherries (*Prunus avium*) in the markets were seen to be rather severely attacked by *Cladosporium carpophilum*. *Ascochyta pisi* was found on *Onobrychis sativa*.

Rossi (V.). **Contributo allo studio della patologia vegetale in Somalia.** [A contribution to the study of plant pathology in Italian Somaliland.]—*Agricolt. Colon.*, xxv, 11, pp. 522–528, 1931.

In Italian Somaliland plant diseases are most prevalent towards the end of the hot, wet season and the beginning of the cool season, which is marked by light rains. During this period the following records were made.

Cercospora dolichi caused circular, rugose, reddish spots on the upper surface of the leaves and on the stems of cultivated *Dolichos* [? *lablab*], the old leaves, which were those most affected, withering and falling. The disease is capable of causing much damage.

Cotton grown from Egyptian seed showed a wrinkling of the leaves with ulcerations on the veins and stems, while the leaf stalks were cracked and scaled, similar lesions being present in places on the leaf blades but unrelated to the wrinkling. The nectaries at the base of the main veins were attacked on the under surface by sooty moulds. Other leaves of the same cotton were infected by *Uredo gossypii* [*Cerotelium desmium*].

Mulberry leaves were attacked by *Cercospora moricola*. At first they showed a sort of mosaic consisting of small, hyaline, polygonal

spots evenly distributed over the whole of the under surface; these gradually darkened, and in very advanced stages spots of a dirty chestnut colour were noted on the upper surface. The oldest leaves suffered most, but the stalks and branches remained unaffected. Mulberry leaves with greenish-black spots showed the presence of a *Clasterosporium*. Other mulberry plants, especially those exposed to the wind, were affected by a condition referred to as 'silver leaf', which attacked mostly the leaves nearest the soil, which were very wet, as the ground was irrigated by flooding. At first, the upper surface showed greyish, irregular, indefinitely outlined spots, which gradually developed into the silvery condition. Beneath the silvery areas the under surface of the leaf was concave. Affected leaves became irregularly perforated, rough, hard, and brittle. The condition was due to an abnormal accumulation of calcium oxalate in the epidermal cells (which were eventually killed) and is attributed to physiological disturbances probably due to a virus disease.

Langeron (M.) & Talice (R. V.). **Nouvelles méthodes d'étude et essai de classification des champignons levuriformes.** [New methods of investigation, and an attempt at the classification of yeast-like fungi.]—*Ann de Parasitol. Humaine et Comp.*, x, 1, pp. 1–80, 5 pl., 32 figs., 1932.

In the introductory part to this paper the authors give a brief historical outline of the various systems hitherto suggested for the classification of yeast-like fungi, some of which are important human and animal pathogens, and state their reasons for agreeing with Mlle Berkhout [*R.A.M.*, iii, p. 555] in her creation of the genus *Candida* to include the forms which had been previously referred to *Monilia* Gmelin. On general lines they accept the classification proposed by Ciferri and Redaelli [ibid., viii, p. 676], but point out that the division by these workers of the yeast-like fungi into two main groups based on whether they produce or do not produce filaments in culture is not substantiated by their own studies [considerable details of the technique of which are given]. In their experience the formation of mycelial filaments is very capricious and depends on a large number of external factors; under certain conditions it was found that the filaments were formed more readily in liquid than on solid media, and on the latter inside the medium rather than on its surface. They proceed to show that these filaments represent a definite sporogenous (but not conidial) apparatus with specific morphological characters which they suggest using as a basis for the botanical classification of the organisms.

The organisms investigated by the authors are all referred to the section Mycotorulaceae of Ciferri's and Redaelli's family Torulopsidaceae [loc. cit.]; they are divided into two main groups, the first of which forms creamy colonies in culture and includes five genera, namely, *Mycotorula*, characterized by blastospores disposed in simple and regular verticils or clumps; *Mycotoruloides*, with blastospores disposed in regular, composite, and spread out verticils and terminal clumps; *Candida*, with blastospores disposed in terminal chains and in more or less regular verticils; *Mycocandida*, with a very branched filamentous apparatus, short

terminal chains of spores, and rudimentary verticils; and *Blastodendrion*, characterized by arbuscular formations consisting of stalagmoid blastospores. The second group, *Geotrichoides*, forming membranaceous colonies, only comprises one genus, namely, *Geotrichum*, characterized by the presence of a true mycelium which breaks up into arthrospores, and the absence of blastospores; it forms a solid film on the surface of liquid media. A key to these genera is appended.

HANSEN (H. N.) & SMITH (R. E.). **An analysis of variation in Botrytis cinerea by single-spore cultures.**—Abs. in *Phytopath.*, xxii, 1, p. 11, 1932.

Twenty-five monospore cultures were made from each of eight duplicate monospore cultures of 47 strains of *Botrytis cinerea* or closely related types isolated from various plants. In a few of these cultures considerable variation appeared in regard to the presence or absence of sclerotia, conidial production, colour and type of mycelium, and other features of gross morphology. In one strain (X) 24 of the cultures (*x*) appeared uniform and like the parent, while 1 (*a*) varied in absence of sclerotia and in mycelial type. Further studies were made on potato-dextrose agar cultures of this strain to the F_4 generation, during which period *x* remained uniform throughout, while in the F_1 generation *a* separated into 7 (28 per cent.) like the parent and 18 (76 per cent.) of an entirely new type (*b*). The latter continued uniform to the F_4 generation. In the F_2, *a* separated into 12 (48 per cent.) of *a*, 7 (28 per cent.) of *b*, and 6 (24 per cent.) of a new type (*c*). In the F_3, *a* separated into 2 (8 per cent.) of *x*, 15 (60 per cent.) of *a*, 5 (20 per cent.) of *c*, and 3 (12 per cent.) of a new type (*d*). Type *c* separated into 1 (4 per cent.) of *x*, 14 (56 per cent.) of *a*, and 10 (40 per cent.) of *c*. Species of *Phoma*, *Fusarium*, and *Ramularia* behaved similarly.

JOCHEMS (S. C. J.). **Verslag van het Deli Proefstation over het jaar 1931.** [Report of the Deli Experiment Station for the year 1931.]—*Meded. Deli Proefstat. te Medan-Sumatra*, Ser. II, lxxiv, 53 pp., 1932.

This report contains the following references of phytopathological interest. To the list of plants liable to infection in Sumatra by slime disease [*Bacterium solanacearum*: *R.A.M.*, viii, p. 74] may now be added *Gynura* sp., *Gerbera* sp., and *Chrysanthemum sinense*. All the F_2 seedlings of crosses between Deli tobacco and *Nicotiana* species [other than *N. tabacum*], as well as back-crosses of the F_1 with Deli tobacco, showed an exceptionally high percentage of slime disease [ibid., x, p. 561].

Leaf spot (frog-eye) [*Cercospora nicotianae*: ibid., xi, p. 134] has been found to attack transplanted tobacco seedlings and also ripe seed capsules. In a preliminary pot experiment, a heavy application of nitrogen resulted in an increased incidence of the type of leaf spot associated with the curing stage [loc. cit.] while the white, membranous spots ordinarily occurring on plants in the field were less in evidence.

Various forms (about six) of the virus disease of tobacco

known as 'peh-sim' have been observed. Experiments in the transmission of 'gilah' [see next abstract], another virus disease, by means of grafting, gave positive results both when healthy scions were grafted on diseased stocks and vice versa. The 'korab' disease was found to be similarly transmissible from infected to healthy scions and vice versa.

Glomerella lycopersici Krüger, *Botrytis verrucosa* v. Beyma, and *Botryodiplodia theobromae*, isolated from cured tobacco of inferior quality, were found capable of causing a wet rot of freshly gathered leaves on inoculation into the midrib. Both the top rot of fully matured field tobacco and the decay of stalks ['hollow' or 'drip stalk'] in the barn were found on examination by Prof. Nakata to be due to *Bact.* [*Bacillus*] *aroideae* [ibid., viii, p. 554; ix, pp. 614, 747].

THUNG (T. H.). **De krul- en kroepoek-ziekten van Tabak en de oorzaken van hare verbreiding.** [The curl and crinkle diseases of Tobacco and the causes of their dissemination.]—*Proefstat. Vorstenlandsche Tabak, Meded.* 72, 54 pp., 30 figs., 3 diags., 1932. [English summary.]

The so-called 'kroepoek' ('crinkle') diseases of tobacco, which cause considerable damage in Java by reducing the yield of the crop and impairing the quality of the finished product, are considered to be probably identical with the 'Faltenzwerg' of Peters and Schwarz (*Mitt. K. Biol. Inst. für Land- und Forstwirtsch.*, 13, 1912), the 'gilah' of Jochems [see preceding abstract], the 'kroepoek' and 'krekoh' of Keuchenius (*Meded. Besoeki Proefstat.*, 14, 1915) and others [see also *R.A.M.*, ii, p. 9], the 'crinkle' of Roberts (*Bull. Entomol. Res.*, xxi, p. 169, 1930), and the 'crinkly dwarf' of Storey [*R.A.M.*, xi, p. 76].

Three types of 'kroepoek' may be differentiated, viz., (1) the common kroepoek, in which the leaf edges are curled in places towards the dorsal side, and show thickenings and outgrowths (enations) of the veins; (2) curl disease (krulziekte), characterized by the curling of the whole leaf edge towards the dorsal side, with enations of the veins, the lamina arching towards the ventral side between the finer veins and the distance between the latter being much reduced; and (3) the transparent kroepoek, distinguished by the curling of the leaves towards the ventral side and the clearing of the veins, enations being absent. The first symptoms of kroepoek may appear on a part only of a single leaf, but all the new leaves subsequently formed show the disease. The disease, therefore, is systemic.

Sections through a thickened vein of a kroepoek leaf show that the cortical parenchymatous cells contain an abnormally large amount of chlorophyll; if leaf appendages arise a long palisade parenchyma is formed along the original dorsal side, while cortical cells without chloroplasts are no longer present. The regular structure of the healthy vein has entirely disappeared; the epidermal cells are of very unequal size, and in addition to the proliferation of the mesophyll a very unevenly distributed multiplication of the phloem is apparent, while the wood vessels become irregularly scattered. In a healthy tobacco vein the vascular bundle is bicollateral and at the outer side of the phloem is a

band of collenchymatous pericycle. The sieve-tubes and companion cells have relatively wide lumina. In a kroepoek-diseased vein, on the other hand, the sieve-tubes are compressed, the cell walls swollen, and the remnants of the pericycle are surrounded by the enlarged and necrotic phloem tissue.

In curl disease there are more layers of densely aggregated spongy parenchyma cells with few intercellular spaces than normal. 'Transparent kroepoek' differs from the other two types in the absence of chlorophyll from the cortical cell tissue, except in the starch sheath. The number and size of the parenchyma cells are increased and chlorophyll is also absent from the outermost subepidermal cell layer. The 'transparent' effect is produced by the widely extended parenchyma without chloroplasts. Here, too, the phloem is necrotic.

Each of the above-mentioned diseases is transmissible by grafting, but not by means of the juice of infected plants; they are not transmissible by the seed. Diseased plants are found chiefly near villages or the curing barns; in places the incidence of infection may reach 50 to 70 per cent. Infection does not originate in the soil, as shown by the fact that plants grown in pots with soil from infested village areas and then placed in the field do not contract the disease, while those grown in sterilized soil and transferred to the neighbourhood of infected villages develop the kroepoek symptoms. The dissemination of infection by means of some aerial agency is further proved by the fact that plants grown under fine-mesh cages remain healthy, while those in large-mesh cages become diseased.

Experiments under controlled conditions in the transmission of the kroepoek group of diseases by various insects, including thrips and the aphid *Myzus persicae*, gave positive results only in the case of the white fly (Aleurodidae), a species of *Bemisia* being probably implicated [cf. ibid., xi, p. 238]. The three types described above remain constant with insect transmission as well as grafting. The incubation period in graft infections is about 4 weeks. In one of the tests with Aleurodidae 235 insects were introduced from naturally infected tobacco on to 42 plants in pots in the greenhouse between 30th September and 6th October, 1931, 22 of the plants being found diseased on 18th October and 33 on 11th November. Six of the latter had curl and the rest the ordinary kroepoek. Kroepoek symptoms were induced in tomato plants by grafting diseased tobacco tops on them, and infection was further transmitted by white flies from diseased tobacco to *Nicotiana glauca* and *N. rustica*. Malformations strongly reminiscent of kroepoek have frequently been observed near Klaten on the wild plant *Synedrella nodiflora* and the extensively cultivated *Zinnia elegans*; two white flies were transferred, after three days' feeding on diseased *Zinnia*, to a healthy tobacco plant which developed kroepoek in 14 days.

The number of white flies on tobacco was found to increase on the outskirts of the villages and to be larger on young than on older plants. Statistical observations on the epidemiology of kroepoek indicate that the percentage of infection in the Aleurodidae remains constant throughout the tobacco season.

DUFRÉNOY (J.). **La formation de tetraèdres d'oxalate de calcium dans les cellules de Tabac affectées par le Bacterium tabacum.** [The formation of tetrahedra of calcium oxalate in the cells of Tobacco affected by *Bacterium tabacum*.]—*Comptes rendus Soc. de Biol.*, cix, 8, pp. 608–610, 2 figs., 1932.

The vacuoles of the green cells of normal tobacco leaves, and especially those of the hairs, are known to be rich in the monoclinic crystals known as 'sand crystals' [*R.A.M.*, viii, p. 15], the vacuolar juice being more acid than P_H 5 (probably close to P_H 4). In leaves infected by *Bacterium tabacum*, the acidity of the vacuolar juice appears to be diminished, judging by the plentiful formation of tetragonal crystals of neutral oxalate in the vacuoles of the cells within the affected areas. The spots rapidly expand during rainy weather, when the bacterial zoogloeae penetrate between the cells, which remain alive and retain their chondriosomes and chloroplasts while forming an excess of oxalate in their vacuoles. On the other hand, the lesions tend to cicatrization during sunny weather by the formation of an annular cushion involving several layers of parenchymatous cells, of which the large central vacuole is filled with phenolic compounds and tetrahedra of calcium oxalate.

MEURS (A.). **Bestrijden en voorkomen van topziekte.** [Control and prevention of top disease.]—*Deli Proefstat. te Medan-Sumatra Vlugschr.* 59, 3 pp., 1932.

Full directions are given for the preparation and application of the boric acid solution which has proved so effective in the control of top rot of tobacco in Sumatra [*R.A.M.*, x, p. 561]. The results of recent tests have shown that a dose of 6 mg. of boric acid per plant dissolved in ½ l. of water (solution is easier in water heated to 45° to 50° C.) is necessary to ensure complete control. For the prevention of the disease on a large scale on white, subhydric soils, the boric acid solution should either be poured into the plant holes or applied to the seedlings immediately after setting.

Legislative and administrative measures.—*Internat. Bull. of Plant Protect.*, vi, 2, p. 28, 1932.

ITALIAN SOMALILAND. By a Decree of 14th March, 1931, a Phytopathological Service was instituted for Italian Somaliland under the Office of Agriculture, with the following duties: (*a*) to conduct microbiological, pathological, and zoological research as applied to agriculture; (*b*) to provide for the supervision of the nursery and other establishments concerned in commercial plant production; (*c*) to arrange for the distribution of information relating to plant diseases and pests and their control; (*d*) to supervise the importation and exportation of plants with a view to preventing the introduction of new diseases and pests and the spread of those already present; and (*e*) to issue certificates relating to the health and origin of plant consignments.